

SOFTWARE REVIEWS

PFS:File • SkiWriter II • The Print Shop • PROMAL

May/June 1985
\$2.50 U.S.

commodore

microcomputers

\$3.50 Canada ISSN 0744-8724

THE FUTURE_{OF} COMPUTING

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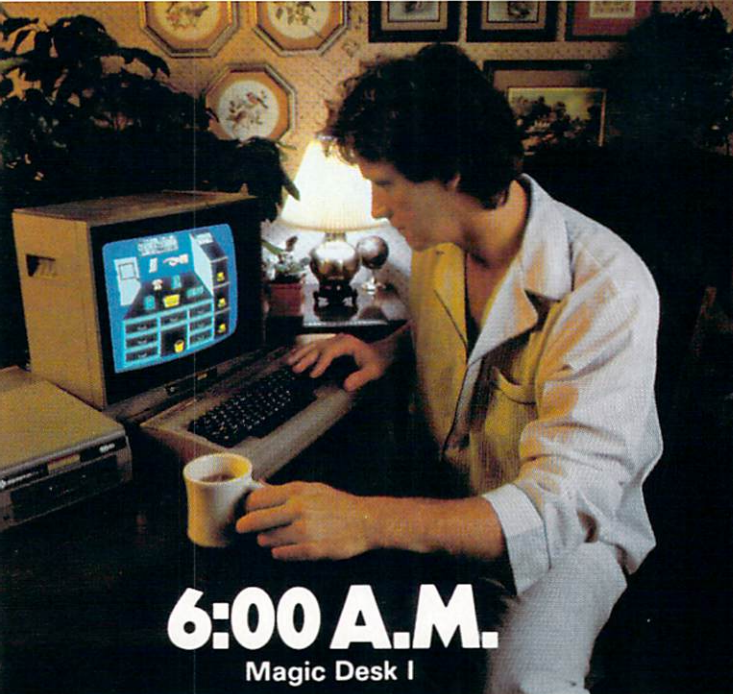
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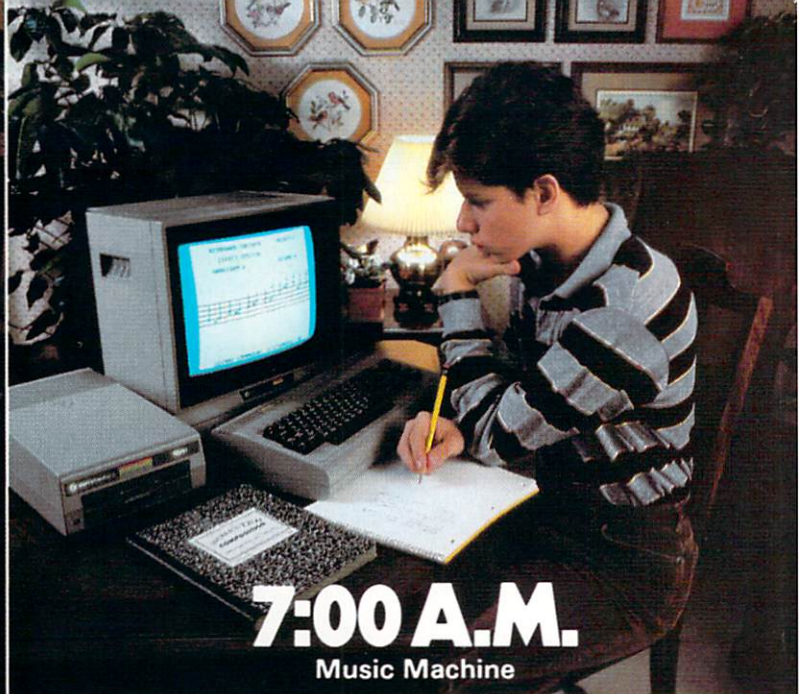


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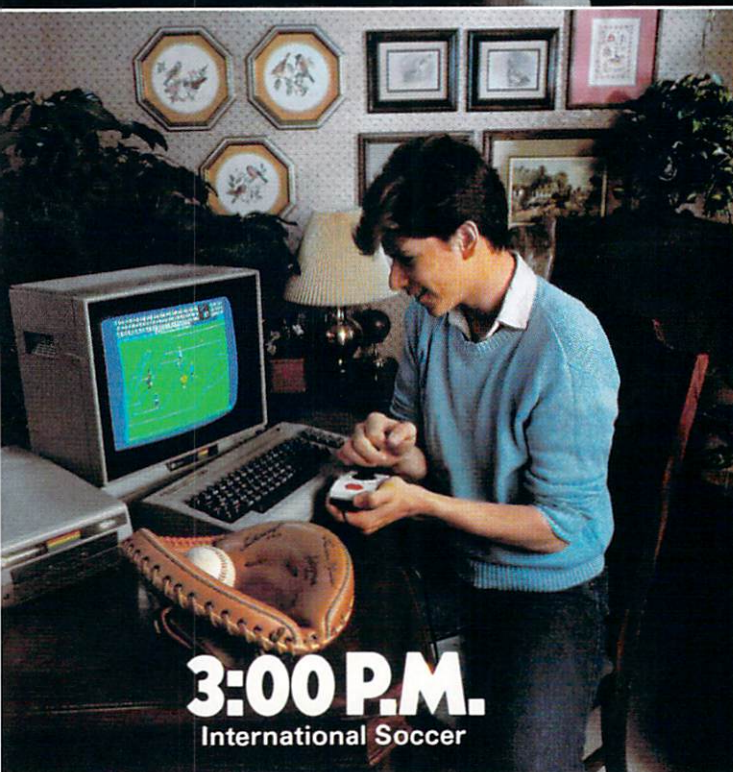
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6:00 A.M.
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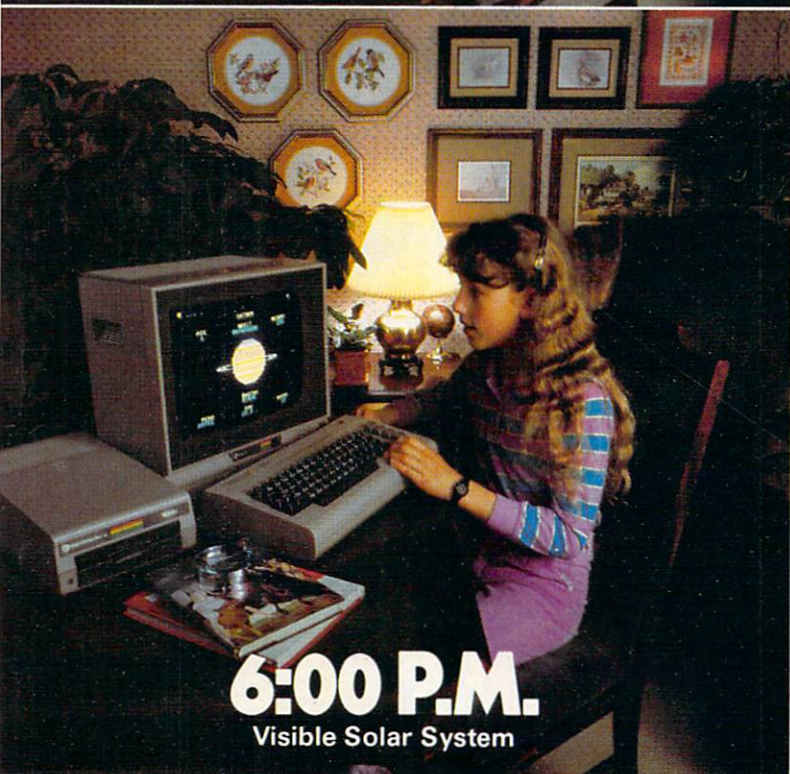
8:00 A.M.

Viduzzles



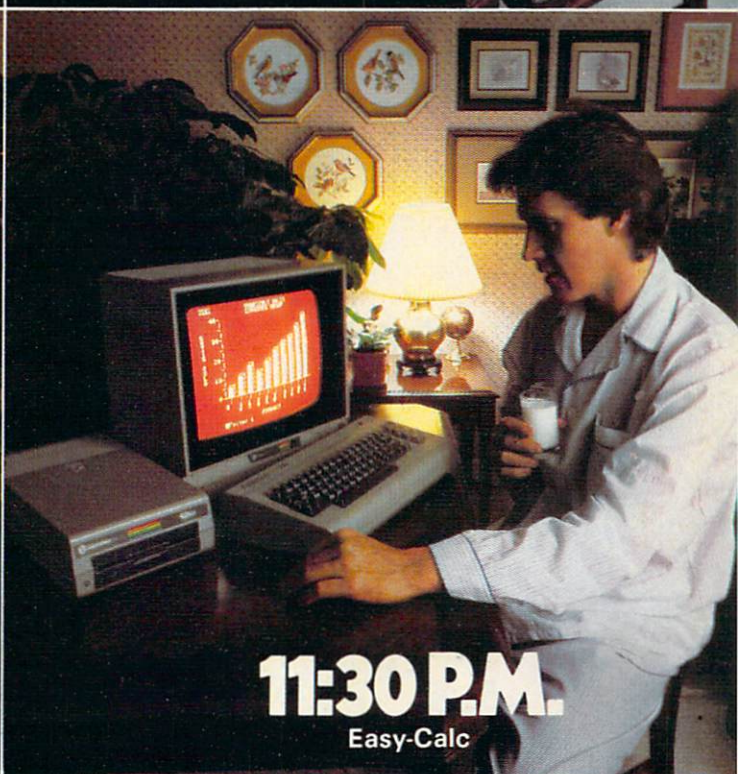
11:00 A.M.

Micro Cookbook



6:00 P.M.

Visible Solar System



11:30 P.M.

Easy-Cal

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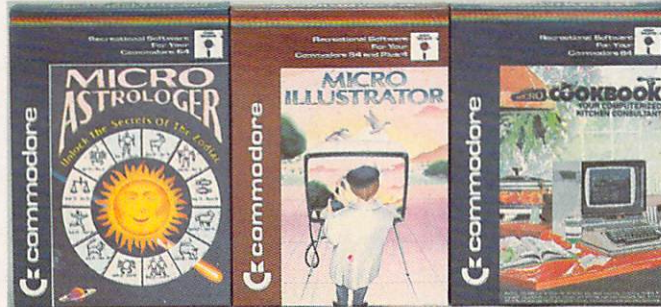
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*Micro Illustrator is also available on diskette for the Commodore Plus/4

Commodore

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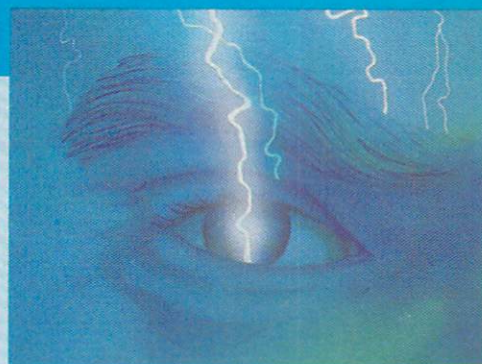
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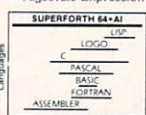
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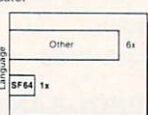
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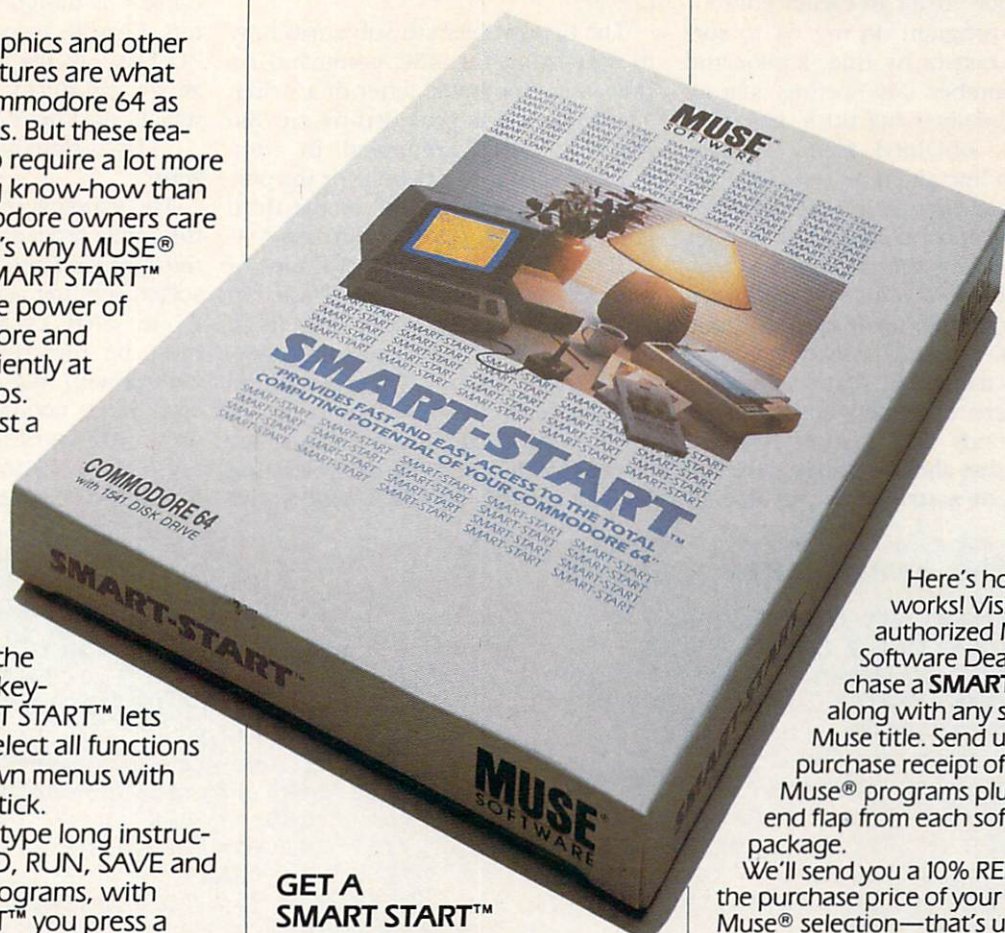
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To the Editor:

I appreciated the article on BASIC list sorting by David Brooks in the January/February issue. For many months I have been using a program called "Filer" from an earlier edition. I use the program on my 64 to sort over 200 entries by title, author and volume number. My sorting subroutine for alphabetizing titles, has been Quicksort, obtained from Commodore's "An Introduction to BASIC."

The Quicksort technique takes 93 seconds to alphabetize 200 book titles and drag along the authors and volume numbers. When I saw the Distribution Counting technique outlined in Brooks' article, I was determined to give it a try. On first glance, the results were extremely impressive—eight seconds flat! I soon realized, however, that alphabetizing by the initial letter of a string was insufficient

for my needs. How then to "go deeper" and sort by the second, third or more letters of a string? How much time would accrue? Could the distribution counting method lend its power?

The first problem to solve was how to sort using the ASC command on other than the initial letter of a string. The answer was provided by our old friend the MID\$ command. By combining the two commands for the purpose of getting the ASC of the third letter of a string, the command ASC (MID\$(A\$,3,1)-64) produces a value of nine for the letter "i" in A\$ "Alice in Wonderland." For a list of titles in an array, the command becomes ASC (MID\$(A\$(I),3,1)). This command worked perfectly in sorting my list of titles by the third letter. I thought that I could blithely repeat the operation for the second and first letters and

wind up with a sorted list, three letters deep. WRONG! Error messages galore. It took me some time to realize that the distribution counting routine does not account for blank spaces because it is designed around initial letters. I had to account for titles such as "D Day" in my sort. The command above produces a value of -32 which must be recognized with an IF ... THEN statement which sets it to zero.

The listing is simply three cycles of the same procedure repeated for the third, second and first letters. The unsorted sending arrays are A\$, B\$ and C. In each cycle, receiving arrays must be dimensioned, in this case ending with AC\$, BD\$ and CE. I left each large enough to accommodate up to 300 entries. In addition, an array of 26 cells must be dimensioned for each clue to receive the alphabetic

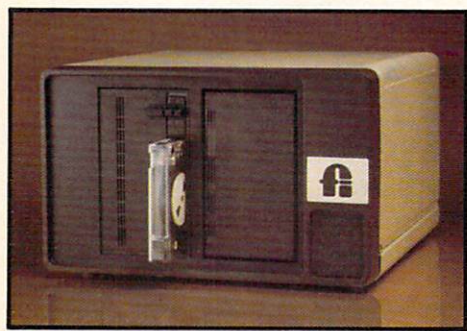
ALPHA ORDER SORT

```
7000 REM ALPHA ORDER BY DISTR
      COUNTING-3 DEEP*BY TOM
      FOSTER*'BTPM
7001 PRINT:PRINT:PRINT:PRINT"PLEASE
      WAIT ABOUT 1 MINUTE WHILE";'EEML
7003 PRINT" THE[SPACE2]
      FILE IS ALPHABETIZED.[SPACE3]
      *THANK YOU*[SPACE3]"'BAFN
7010 DIM R(26),AA$(300),BB$(300),
      CC(300)'BGXG
7020 FOR I=1 TO T:L=ASC(MID$(A$(I),3,
      1))-64'HUWJ
7025 IF L=-32 THEN L=0'FFJK
7030 R(L)=R(L)+1'CJGF
7035 NEXT'BAEH
7040 FOR K=1 TO 26:R(K)=R(K)+R(K-1)
      :NEXT'HTDL
7045 FOR J=T TO 1 STEP-1
      :L=ASC(MID$(A$(J),3,1))-64'JVBS
7050 IF L=-32 THEN L=0'FFJI
7055 I=R(L):AA$(I)=A$(J):BB$(I)=B$(J)
      :CC(I)=C(J)'EOVU
7057 R(L)=I-1'CGWN
7058 NEXT'BAEM
7060 FOR I=1 TO T:PRINT AA$(I):NEXT
      :REM * IF YOU WANT TO SEE FIRST
      CYCLE *'GNCS
7101 PRINT:PRINT:PRINT"IT WON'T BE
      LONG NOW"'DCII
7110 DIM RB(26),AB$(300),BC$(300),
      CD(300)'BHRH
7120 FOR I=1 TO T:LB=ASC(MID$(AA$(I),
      2,1))-64'HWVL
7125 IF LB=-32 THEN LB=0'FHQL
7130 RB(LB)=RB(LB)+1'CNOH
```

```
7135 NEXT'BAEI
7140 FOR KB=1 TO 26:RB(KB)=RB(KB)+RB
      (KB-1):NEXT'HBDO
7145 FOR JB=T TO 1 STEP-1
      :LB=ASC(MID$(AA$(JB),2,
      1))-64'JAHU
7150 IF LB=-32 THEN LB=0'FHQJ
7155 I=RB(LB):AB$(I)=AA$(JB)
      :BC$(I)=BB$(JB):CD(I)=CC(JB)'EWPX
7157 RB(LB)=I-1'CIXP
7158 NEXT'BAEN
7160 FOR I=1 TO T:PRINT AA$(I):NEXT
      :REM * IF YOU WANT TO SEE SECOND
      CYCLE *'GODU
8001 PRINT:PRINT:PRINT"I'M ALMOST
      FINISHED."'DCYI
8010 DIM S(26),AC$(300),BD$(300),
      CE(300)'BGFH
8020 FOR I=1 TO T:M=ASC(AB$(I))
      -64'GPYJ
8025 IF M=-32 THEN M=0'FLLJ
8030 S(M)=S(M)+1'CJKG
8035 NEXT'BAEI
8040 FOR KK=1 TO 26:S(KK)=S(KK)+S
      (KK-1):NEXT'HXAN
8045 FOR JJ=T TO 1 STEP-1
      :M=ASC(AB$(JJ))-64'ISBS
8050 IF M=-32 THEN M=0'FLLJ
8055 I=S(M):AC$(I)=AB$(JJ)
      :BD$(I)=BC$(JJ):CE(I)=CD(JJ)'EUWV
8057 S(M)=I-1'CGYO
8058 NEXT'BAEN
8060 FOR I=1 TO T:PRINT AC$(I):NEXT
      :REM * IF YOU WANT TO SEE FINAL
      CYCLE *'GNDT
8070 RETURN'BAQH
```

(END)

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FII's Lt. Kernel with streaming tape option installed.

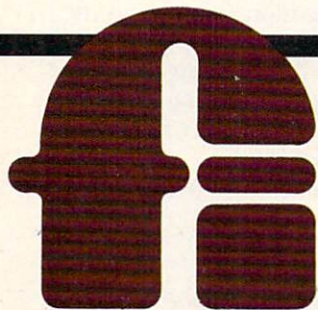
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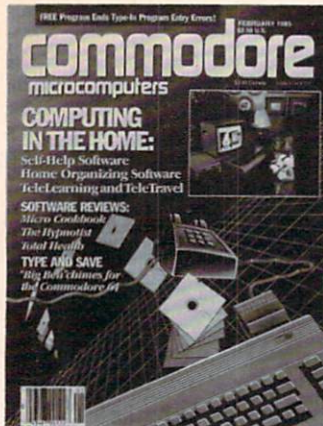
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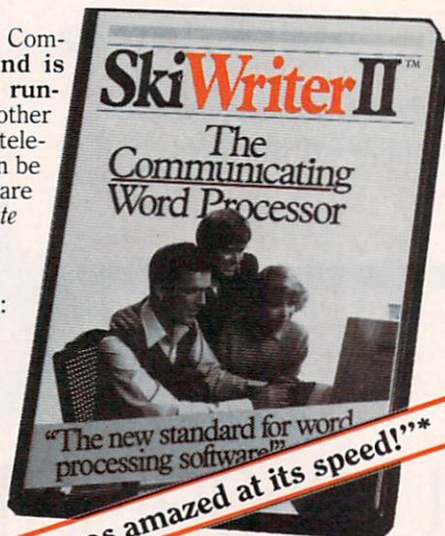
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"I was amazed at its speed!"

LETTERS

ASCII values.

The entire new program (three deep) decreased the sorting time by 40 seconds or over 50%. I am sure that a bit of crunching by Commodore readers can make it even more efficient.

Thomas Foster
Bel Air, Maryland

Editor's Note: To use this subroutine, you must have already dimensioned and initialized the arrays AS(), BS() and C(). If you want to use only AS(), remove all portions of lines referring to BS(), BB\$(), BC\$(), BD\$(), C(), CC(), CD() and CE(). Lines affected would be 7010, 7055, 7110, 7155, 8010 and 8055. **C**

To the Editor

We are coming to see the Commodore 64 in use in the science classroom for a variety of applications including laboratory enhancement, data manipulation, "dry labs" or pre-labs, as well as classroom management and word processing.

I am interested in contacting other science teachers and students who use the Commodore 64 in the science classroom in order to share science programs written by the teacher and/or student, evaluate commercial software and publicize science software available for the 64.

This last item is quite important in the science field as many decision makers in the school districts are unaware of the many science applications for the 64.

Besides the obvious educational benefits, there are other advantages to the collaboration of science teachers, Commodore 64's and students:

1. We expose more students to the world of computing.
2. We allow the students a practical application for their programming skills, for both the beginner and experienced programmer.
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The network operates 6PM–7AM every weeknight, and 24 hours on Saturday, Sunday and Holidays. All you need to access PlayNET™ is a COMMODORE 64*, DISK DRIVE and MODEM.

1 TALK.

By typing on-line you can *talk to anyone*, or everyone, on the system. Meet fascinating people and make new friends from coast to coast.



2 ELECTRONIC MAIL.

You can *send private messages* to people on the system, and the message will be waiting when they sign on!

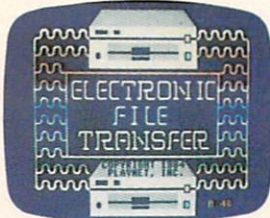
3 BULLETIN BOARDS.

You can *post announcements*, or check the listings of other members. There are lots of boards for hobbies and special interests! If you don't find the one you're looking for—create your own!



4 FILE TRANSFER.

You can even *transfer non-commercial programs* to other members! There is a small extra fee for this service.

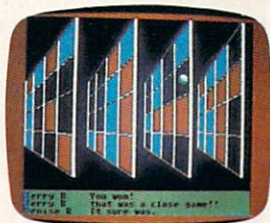


5-17 GAMES! GAMES! GAMES!

PlayNET lets you play exciting games with real people, not just a computer. All our games have *full color graphics*, and they're all *interactive!*

- Plus the added feature of being able to talk with your opponent while you play. Discuss strategy, comment on moves, even try and psych your opponent out!
- New games are added all the time, and there are tournaments for every skill level.

CURRENT GAMES INCLUDE:



- Backgammon
- Boxes
- Capture the Flag
- Checkers
- Chess
- Chinese Checkers
- Contract Bridge
- Four-In-A-Row
- Go
- Hangman
- Quad 64™
- Reversi
- Sea Strike™

18 MORE! MORE! MORE!

There's *on-line updating* of your PlayNET Software as games and services are added. You have access to PlayNET's *Shopping Center* and *Information Center*, and every month you'll get our *Newsletter*.

19 YOUR SATISFACTION IS GUARANTEED for 30 days

(or your full subscription price will be refunded upon receipt of the package).

This is all you pay:

- \$39.95 for the PlayNET Software Package (3 disks and a User Manual), Monthly Newsletter, and 90 MINUTES ON-LINE TIME FREE!
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Here's how you can become a member!

It's easy to join, simply call PlayNET on the toll-free number, 1-800-PLAYNET, or send the coupon below and access all your Commodore 64 has to offer. The sooner you do, the sooner PlayNET can put the whole country at your fingertips!

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YES! I WANT PlayNET TO PUT THE WHOLE COUNTRY AT MY FINGERTIPS. I UNDERSTAND THAT MY SATISFACTION IS GUARANTEED FOR 30 DAYS (or my full subscription price will be refunded upon return of the package) I may cancel my membership at any time by writing PlayNET.

Bill me on my charge card for \$39.95. (Plus sales tax for New York State residents). No checks, cash or money orders accepted. Please send me the PlayNET Software, User Manual, and 90 minutes of free on-line time.

Please print.

Name _____

Address _____

City _____ State _____ Zip _____

Phone (____) _____

Check one: ☐ MasterCard ☐ VISA

Card # _____

Exp. Date _____

Signature _____





Printer Stand

The Write Angle desk-top printer stand from Northeast Peripherals (RD #1, Box 44, Somerset, New Jersey 08873) puts computer output at the best viewing angle. Crafted from clear acrylic in a one-piece design, this space-saving stand offers convenient paper storage below the printer. Printed fan-fold paper will automatically stack neatly behind the stand. The anti-skid protective feet hold your printer and stand securely without marring your furniture. The Write Angle printer stands carries a lifetime guarantee. It comes in three sizes retailing from \$29.95 to \$39.95.

Compiler

Nanosec (Lincoln Plaza, 3544 Lincoln Avenue, Ogden, Utah 84401) has released *Pro-Compiler*, a full 32-bit arithmetic compiler that can include other BASIC programs or subroutines. It doesn't generate slow P-code or its own library overhead and compiles your BASIC program down to straight machine code. While doing this, it also optimizes your code. Now your compiled programs can have up to 48K. Suggested retail price is \$99.95.

Computer Graphics Dictionary

The theory and practice of computer graphics, a technique nearly 20 years old but only recently coming into widespread use, has spawned a new vocabulary to explain its ideas, principles and procedures. *The Dictionary of Computer Graphics*, recently published by Knowledge Industry Publications (701 Westchester Avenue, White Plains, New York 10604), brings this scientific vocabulary within the reach of laymen, students and computer graphics artists.

The dictionary provides detailed, frequently illustrated explanations of 200 terms, such as achromatic color, algorithm, CAD, cel, fractals and Z-buffer. Photos and diagrams illustrate such terms as digitizing, plotter and fractal surface. A special eight-page four-color insert illustrates the complexity of computer-generated images and graphics techniques. The book also includes a select list of references, associations and publications.

The book is written by Dr. John Vince and retails for \$34.95.

New Dot Matrix Printer

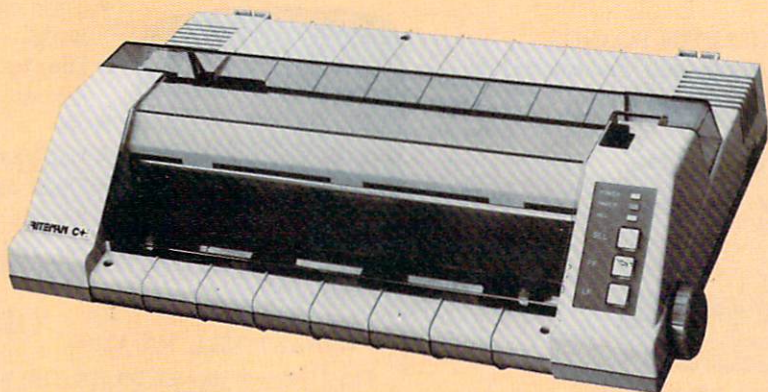
Inforunner Corporation (Airport Business Center, 431 N. Oak Street, Inglewood, CA 90302) has released the Riteman C+, a dot matrix printer for Commodore computers with a print speed of 105 characters per second. With a built-in Commodore interface, the Riteman C+ can be directly plugged into the Commodore serial port. It also includes cables and connectors.

The unique front-loading design of the Riteman C+ allows computer paper to snap right into the adjustable front tractor sprockets without any alignment problems. It also lets you use plain paper of any thickness (even card stock). The built-in printer stand keeps paper right under the Riteman C+, away from its cables and connectors.

The logic-seeking bi-directional Riteman C+ prints in a nine-by-nine dot matrix. In its reverse field mode, the Riteman C+ produces white letters on a black background. It prints 82 Commodore graphic characters and produces true descenders.

Other standard features of the Riteman C+ include equipped friction fee, adjustable three through 10-5/8 tractor feed, 96-character ASCII set and four international character sets. It has seven printing modes: standard, double strike, emphasized, compressed, underline, italic and super/subscript.

Suggested retail price for the Riteman C+ is \$299 with a one-year warranty on parts and labor.

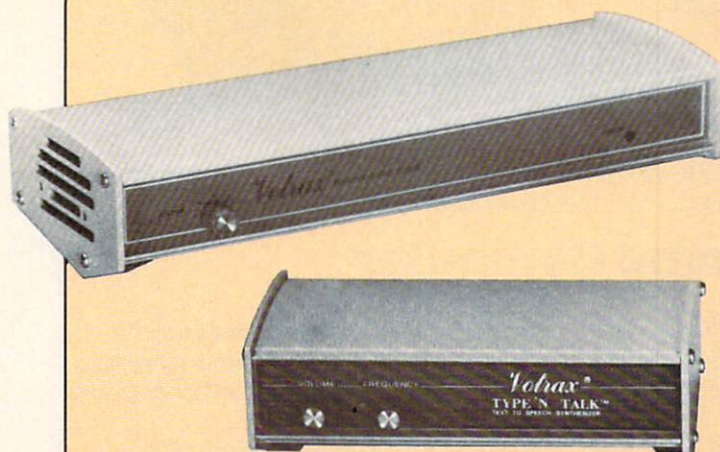


Electronic Yellow Pages

A new service is now available which provides instant access to every Yellow Page directory in the country. The Instant Yellow Page Service lets you dial in and retrieve business information on-line from a data base of over six million Yellow Page listings.

Any printing terminal, communicating word processor or computer with modem can be used to access the Instant Yellow Page Service. Charges are \$1.00 per minute for connect time and ten cents per record printed, plus a nominal subscription fee of \$15 per month. Over 300 different Yellow Page titles are available nationwide, and for some states, every business in the Yellow Pages may be accessed.

For more information, contact Instant Yellow Page Service, American Business Lists Inc., P.O. Box 27347, Dept. N, Omaha, Nebraska 68127. The phone number is 402-331-7169.



Voice Synthesizers

Votrax (1394 Rankin Road, Troy, Michigan 48083) has introduced two devices that make personal computers talk. The two peripherals—Personal Speech System (PSS) and Type-'N-Talk—convert computer data into spoken English. Each operates from a CMOS synthesis chip and general microprocessor.

Both products are designed to eliminate the need for extensive phonetic skills, resulting in speech that is 95% conversationally accurate. Users enter standard English text through the keyboard and a Z80 microprocessor, then use standard pronunciation rules to generate correct word sounds through the Votrax SC-01, a CMOS speech synthesis chip developed by Votrax.

PSS is priced at \$395 and Type-'N-Talk retails for \$249.

Home Medical Software for the 64

Nearly every household has one or more home medical manuals. These manuals are usually organized by type of illness or anatomical region, making it difficult to pinpoint the cause of one's ailment unless the symptoms are familiar. Thanks to the power of the computer, it is now possible to identify the most likely illness, even if it is obscure and unfamiliar.

Navic (Box 14727, North Palm Beach, Florida 33408) has released *Family Medical Advisor*, a data base of nearly 200 medical conditions. The user simply responds yes or no to a series of questions (symptoms and signs) in layman's terms. The computer then analyzes the accumulated data and displays the most probable medical condition. Related disorders with similar symptoms are also identified and listed on the monitor screen in descending order of probability.

The program retails at \$38.00.

More Help for the Handicapped

Computer Technology for the Handicapped, by Closing the Gap (P.O. Box 68, Henderson, Minnesota 56044), is a treasury of state-of-the-art microcomputer applications written for special education and rehabilitation professionals as well as the handicapped, their families and associates. This 260-page book details 45 of the more than 80 presentations made at the CTG Annual Conference and focuses on how computer technology can help the handicapped or disabled person. Topics include microcomputer applications in all disability areas—hearing and speech impaired, blind and vision impaired, physically and mentally handicapped—as well as complete contact information on all presenters, a listing of nearly 60 hardware and software producers exhibited at the conference and an introduction by Dolores Hagen, co-founder of Closing the Gap and author of *Microcomputer Resource Book for Special Education*.

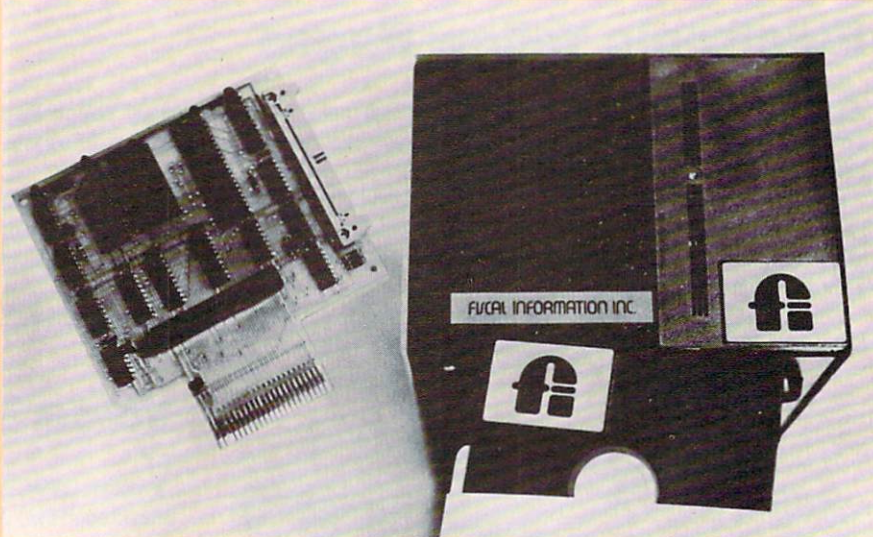
Computer Technology for the Handicapped retails for \$17.95. For more information on this book or the other computer-related services Closing the Gap provides to special education and rehabilitation professionals and handicapped persons, contact Closing the Gap at the above address or call 612-248-3294.

Hard Disk Subsystem and DOS for the 64

Fiscal Information (P.O. Box 10270, Daytona Beach, Florida 32020) has announced a new hard-disk subsystem and DOS for the Commodore 64. The system supports storage capacities from five megabytes to 144 megabytes and transparently implements all Commodore 1541 floppy DOS functions.

The DOS uses no normally available user memory in the 64. The software included with the package significantly upgrades the 64's BASIC with additional run-time functions and many CBM-like command-line features including auto-start of applications upon power-up.

The package consists of a cartridge port interface, disk/controller subsystem and user-configurable DOS software. Price is expected to be in the \$1,300 to \$1,700 range for a 10 megabyte system (the production interface will be enclosed).



Making Money with Your Home Computer

Moonlighting on your personal computer can help pay for it. Here is a guide for both the novice and experienced user, to profitable ways they may employ the home computer. Using many examples, the author explains the many services the home computer user can provide: preparing mass mailings, programming for businesses, typesetting, creating games and programs for syndication.

The book, *Making Money with Your Home Computer* by Dana K. Cassell, is published by Dodd, Mead & Company (79 Madison Avenue, New York, NY 10016). It retails for \$5.95.

Real-Time Space Adventure

Mindscape (3444 Dundee Road, Northbrook, Illinois 60062) and software author Tom Snyder have produced a new program for the Commodore 64 that is an actual real-time simulation of our solar system. Called *The Halley Project: A Mission in Our Solar System*, the program seeks players who qualify for the top secret project by making them complete a series of navigational tests in an authentic space simulation.

Through the tests and obstacles, *The Halley Project* helps players master basic facts about the solar system. It includes details on Halley's Comet and its orbit, an understanding of gravity, atmospheric conditions and orbital motion, relative size, position and orbit of planets and moons, locations of constellations and how eclipses work.

A multitude of "courses" subjected to random conditions are built into the program to provide a variety of missions for the player. The program records players' progress and speed, encouraging them to undertake missions that will increase their understanding of the solar system.

Suggested retail price is \$44.95.

Time Response Monitoring

Typing Tutor III, recently released by Simon and Schuster (1230 Avenue of the Americas, New York, New York 10020), uses a unique programming technique dubbed "time response monitoring" by its developer, Kriya Systems. The program for the Commodore 64 continually monitors and records the precise time, in thousandths of a second, that it takes for the user to respond to each key. This data is then stored and used to customize current and future lessons to meet each student's specific needs.

For example, a weak left-hand little finger will type A's, Z's and Q's more slowly. Noting this, *Typing Tutor III* will create special lessons to strengthen the student's skill in these letters. Or the student may have an accuracy program with specific letter combinations. *Typing Tutor III* will sense this and automatically create special lessons to strengthen it.

Menu-Driven Disk Operations

Software Intelligence Corporation (P.O. Box 1390, Spring Valley, California 92077-0220) has released *Achiever*, an easy-to-use disk operator for the Commodore 64.

The program provides menu-driven disk operations such as loading, opening, copying, renaming, scratching and closing files. *Achiever* is loaded into memory (RAM) and there it stays to guide the user through disk operations. *Achiever* retails for \$29.95.

TPUG Conference

The fourth annual TPUG (Toronto PET Users' Group) conference will be held in Toronto on May 25 and May 26, 1985. The club is the world's largest Commodore users' group, with a membership of over 15,000. For more information contact Doris Bradley at the TPUG Business Office, 1912A Avenue Road, Toronto, Ontario, M5M 4A1 Canada. The telephone is 416-782-9252.

Science Education Programs

Tech Sketch (26 Just Road, Fairfield, New Jersey 07006), manufacturer of light pens, is introducing three new high school-level science education programs for the Commodore 64.

Each of the new titles is the first in a series planned for three subject areas. The first, in the biology series, is *Structure of Leaves*; the second, in the matter series, is *Molecules and Atoms*; and the third, in the chemistry section, is *Passive Transport*.

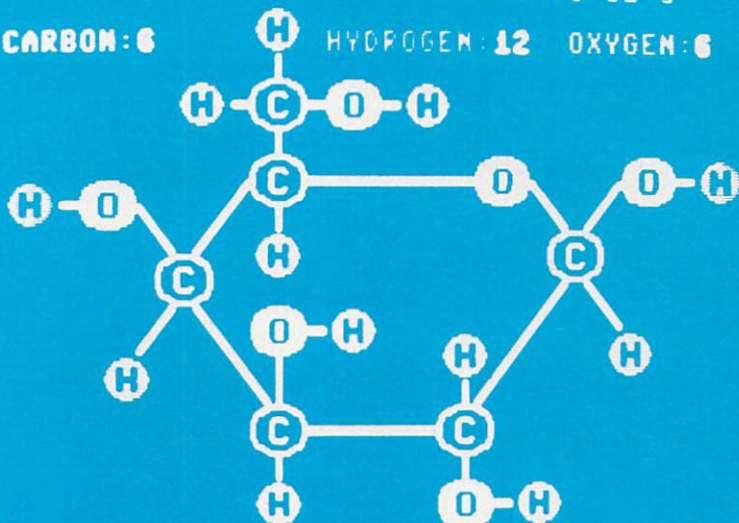
The software makes use of both the computer keyboard and a light pen. The light pen is used to select categories and answers displayed on the screen.

THE FORMULA FOR GLUCOSE IS: $C_6H_{12}O_6$

CARBON: 6

HYDROGEN: 12

OXYGEN: 6



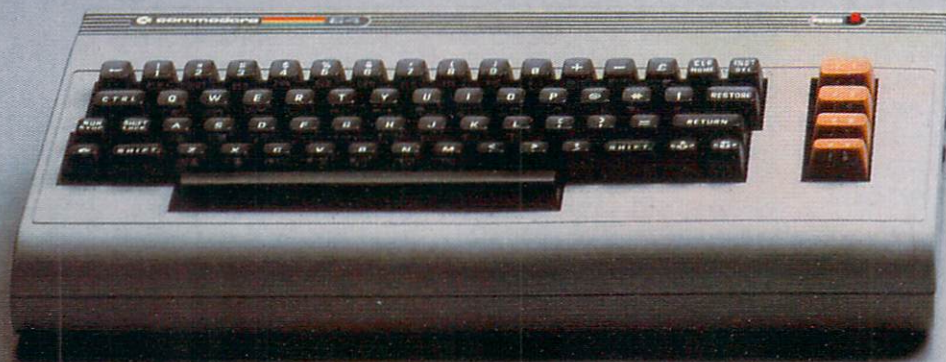
PRESS SPACE TO CONTINUE



Monitor Stand

Suncom's (260 Holbrook Drive, Wheeling, Illinois 60090) new monitor stand has been designed to provide an ergonomically superior work space for both home and office computer use. With a suggested retail price of \$26.95, the monitor stand appeals to users who make comfort a priority.

The stand helps eliminate glare since it can swivel 360 degrees and tilt up and down 12.5 degrees. The heavy-duty stand can hold a computer, video monitor or television set with a screen size up to 14 inches. Its injection-molded plastic shell is reinforced with a composite metal support plate protected by a polyurethane cushion. Available in almond, the monitor stand measures 11 inches wide by ten inches deep and a half inches high.



**IT'S NOT
HOW LITTLE IT COSTS,
IT'S HOW
MUCH YOU GET.**



We have a surprise for all those people who think that in order to get more you have to pay more.

The Commodore 64.™

We also have a surprise for all those people who think they have to settle for less just because they're paying less.

The Commodore 64.

The Commodore 64 has a full 64K memory, high fidelity sound and high resolution, 16-color sprite graphics.

It's fully capable of running

thousands of programs for schools, business or funny business.

But the Commodore 64 is about one third the price of the 64K IBM PCjr.™ or the Apple IIe.™ In fact, for about the price of those computers alone you can get the Commodore 64, a disk drive, a printer and a modem—a powerful computing system.

We don't do it with mirrors, we do it with chips. We make our own. So we can make them for less, more efficiently and more

economically than people who don't. (Which is just about everybody else.)

So because it's a 64, it's powerful. Because it's a Commodore, it's affordable. And because it's a Commodore 64, it's the world's best selling computer.

COMMODORE 64

IT'S NOT HOW LITTLE IT COSTS,
IT'S HOW MUCH YOU GET.

PFS:File

Computer: Commodore 64
Publisher: Software Publishing
 1901 Landings Drive
 Mountain View, CA
 94043

Medium: Disk

Software Publishing has finally translated *PFS:File* into a Commodore 64 version. This is significant for two very important reasons: it "legitimizes" the 64 in the eyes of people who thought that only the IBM and Apple machines were valid in a business/professional environment and it marks a successful translation true to the integrity and purpose of the original.

If I didn't know better, I would have sworn that Software Publishing invented the term "user friendly." *PFS:File* is so easy to use, you don't even need documentation to have it running within minutes. Everything is menu-driven so that the average user can concentrate on the filing situation, not the internals of the program.

Though *PFS:File* is so easy to use that an average computer user won't even have to read the 81-page manual, I do encourage you to do so. In fact, the *PFS:File* manual—by manual author Briana Burns—is unquestionably the best package documentation I have ever used. It is everything a manual should be and more: easy to read, graphically pleasant to the eyes, and convenient to use. It has quick guidelines, an instant-access index and terrific screen illustrations.

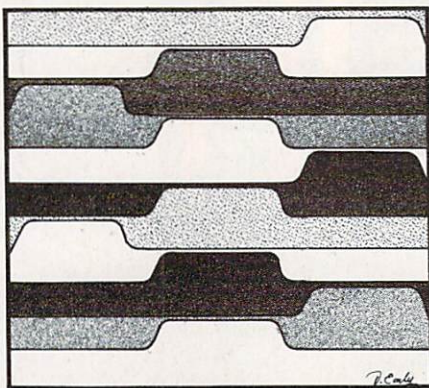
There are 17 built-in error messages which cover a gambit of user situations. Because of the efficient design of this product—and with a little common-sense usage (for example, remember to shut the disk drive door)—you'll probably never run into an error message or a problem.

The Program

PFS:File is unpretentious. Although it has many powerful features found on full-fledged database management programs, it is—and is advertised as—a filing program.

Another unique feature of *PFS:File* is that it can be used either as a stand-

PFS:File is so easy to use, you don't even need documentation to have it running within minutes.



alone program or as an integral team member with other PFS products. Although there are seven components in the PFS applications network so far only two of these packages have been translated to the 64: *PFS:File* and *PFS:Report*.

It takes almost two minutes to load the self-booting *PFS:File* program (*PFS:File* is a long program). After a simple anti-piracy scheme executes, the user is transported into the main menu. The menu gives the user six subroutine options, including: "Design File," "Add," "Search/Update," "Print," "Remove" and "Exit." Also included on the main menu is a prompt which asks the user to input the file name (not necessary, because the program automatically detects the name if one exists on the disk) and the operation mode number.

Design File Mode

This mode is important for two reasons: it formats and initializes a blank data diskette and readies it to receive data, and it starts a procedure so that you can redesign a form, even if that data disk has been in use for a considerable amount of time.

It takes one and three-quarter minutes to initialize a disk. After the disk drive stops operating, the user is put

into a "Design" screen: a blank screen with which you can organize your personal filing system.

As with all *PFS:File* screens, the bottom three lines of the CRT screen are exclusively devoted to program system information. This information includes the name of the file you are creating, what stage of file development you are in, the page number of the file you are working on, frequently used function keys, what they do (*PFS:File* uses dedicated function keys, of which F7—a "go ahead" key—is used the most) and a meter which tells what percent of the disk space you have used so far.

Once inside the "Design" screen, you can personalize your filing system with up to 50 unique item names (data fields), all arranged in whatever graphic manner you decide is best for your particular application. Unlike other database programs, your finished "Design" screen will look like a report form (for example, a medical form), rather than simply a listing of available fields.

In fact, this is just one reason why *PFS:File* is so easy to use. Not only are such computer-unique words (such as database fields) completely avoided, but the user is given the opportunity to actually create the graphic format. This screen-sized prompt, popularized by the program *VisiCalc*, seems more like an empty form—just waiting to be filled in—than a computer input statement.

Once created, a "Design" screen is saved on the data disk. The first item name is inflexible and used as a sort line. (A sort line is the variable field used as the primary avenue of sorting and searching for any specific file. For example, a sort line is often used by the computer to arrange individual fields into some sort of alpha/numeric order.) Another interesting feature of *PFS:File* is the ability to completely redesign the format presentation and variable fields, even after data has been saved. The only restriction is that a data form (a file) cannot be altered after 50% of the storage capability of the data disk has been reached. Why? Well, I'll venture an educated guess by saying that the program uses close to 85K of disk space (half of the

1541's 170K storage limit) to store the previous format, while at the same time, creating an equally large mutated clone. Why mutated? Because the data stays stable, even though the field prompts and their positions are allowed to change.

Add Mode

The "Add" mode is a subroutine which enables the user to enter raw data (names, addresses, phone numbers) into the format established by the "Design" file. How easy is it? It's as easy as going down your screen "page," using cursors and other specially defined function keys, and filling in a blank form. When you are finished, function key F7 saves the data as found on the display screen and wipes the form clean again for another record. The STOP key enables the user to end any mode activity and instantly return to the main menu.

Of course, there are some special conventions which can be added in specific and unusual situations. These include sorting records by zip code, entering in times, entering in dates and filing by customer number. A printout of a single form is also possible when in the "Add" mode.

There is another interesting feature of *PFS:File*, which can be accessed while in the "Add" mode. This special feature is called an attachment. Just as in real life, some file records inevitably contain more information than a single page (or screen full) can physically contain. In real-life filing situations, this is corrected by stapling additional pages to the main file form. In *PFS:File*, these additional pages—up to 31—are electronically linked to the main form (for a specific individual case) to append additional data to the record.

So although there is a restriction to the number of variable item names (50 fields), there is virtually no restriction to the amount of data contained in each item name. As far as I can determine, an item name—as displayed on subsequent attachments—can contain a paragraph's worth of information (for instance, a product description). And as we'll see in the next section, literally any byte of this information can be accessed in the "Search" mode. Of course, attachments do take up disk storage space.

*I can request to
see all records
containing people
living in New York,
who have bought a
widget within the
last year and owe
me money.*

Search/Update Mode

This is probably the most powerful mode of all. The "Search/Update" mode, as the name suggests, serves a dual purpose. First, it allows the user to search through all the records until a condition (or conditions) are met. For example, if I can specify that all records be displayed, they will be, in chronological order backwards. I can request to see all records containing people living in New York, who have bought a widget within the last year and owe me money. *PFS:File* will comply with no trouble at all. Secondly, this mode allows the user to conveniently update or modify any file at any time.

What makes *PFS:File* so powerful in the "Search/Update" mode is its ability to hone in on specific logic conditions with uncanny accuracy. With the use of graphic symbols and a few easy-to-remember rules, any user can quickly command this data base to do amazing things.

With a little practice, the user can even specify such involved search procedures as: find club members who joined between September 1984 and November 1985 (= 84/09..85/11), find customers who owe me more than \$50 (>50), find suppliers who manufacture widgets (... widgets...) and print all names except those starting with "B" (/B...). This may seem complicated, but take my word for it, it's a hundred times easier than learning disk drive commands!

than learning disk drive commands!

Print Mode

A filing program without a print mode is like a fish without water. Fortunately, *PFS:File* contains a built-in "Print" mode. There are two additional subroutines contained in this mode. The first allows you to print any forms which meet your specified conditions (or no conditions, if you like). The second option allows you to create and name up to eight different print specifications for automatic formats.

How does one use the "Print" mode? After entering this mode, the user defines the search pattern in the same manner as in the "Search/Update" mode. Next, the user fills out a "form" which specifies the print options. These options include: number of copies made for each file, lines per page (six for typical mailing labels), whether to print item names, and whether or not to use pre-defined print specs as set up in the "Define Print Spec" section of the same mode.

If the user has established print specs, the program will print out the data in the format specified by that print spec. (These print specs can be modified at will and are saved onto disk.) If not, the user manually indicates (by use of the symbols + and X) which item names will be printed and how they will appear.

Please note that the user has the option of printing the item names along with the variables, so that a "form" look (for instance, a medical chart) can be reproduced. The item names can be dropped in order to produce mailing labels. Also, records can be ordered alphabetically/numerically in the "Print" mode, a feature which is not available in the regular "Search/Update" mode, where records are stored in a last-in, first-out order.

Remove and Exit Mode

These remaining two modes are self-explanatory. The "Remove" mode removes dead records from your database file. This act frees up valuable storage space. The "Exit" mode helps the user get back into BASIC. Also included as a stand-alone utility program is a file backup. I tested this backup routine, and while

Continued on page 116

Cell Defense

Computer: Commodore 64
Publisher: Human Engineered Software
 150 North Hill Drive
 Brisbane, CA 94005
Medium: Disk

The more we understand our bodies, the better we can take care of them. Today's technological tools allow us to understand our bodies like never before. Optical and photographic breakthroughs bring us true-to-life TV movies of our insides from the inside. Biofeedback devices allow us to "see" stress on our forehead or fingertip and visualize it away. And now, interactive computer simulations like *Cell Defense* give us a dynamic understanding of complex biological processes by allowing us to take part in those processes in an entertaining way.

Cell Defense colorfully simulates the defense of an organism (a human body) against attack by a generic virus. The organism is made of three main types of cells: quickly-reproducing labile cells (like those of the skin), stable cells that regenerate more slowly (like liver cells), and irreplaceable perennial cells (like those found in the skeletal muscles, heart, brain and spinal cord.) These cells are arranged in one to eight cell layers, depending on choices made by the player/student during initialization of the program.

As our story opens, some of the cells of the organism in question are being ruthlessly attacked by tiny virus cells whose mission is to convert innocent cells into virus "factories." A converted factory cell will eventually burst, but before it does it will produce several more nasty little viruses to terrorize other cells. The object of this game is to stop those viruses from destroying the organism. The game ends with the destruction of the viruses—or the body.

The game screen is divided into three windows. A small window in the upper right corner of the screen shows the outline of a person. This figure "fills" with a different color as cells die, giving a graphic representa-

Interactive computer simulations like Cell Defense give us a dynamic understanding of complex biological processes.

tion of the current state of the organism. Below this figure, a "scanner" window shows an eight-by-eight layer of cells, indicating healthy and infected cells, bloodstream areas, some cell defense mechanisms, and the player's current position. A joystick controls movement between cells of this matrix and between cell levels. It also controls movement within a single cell of the grid. The largest screen window gives a close-up animated look at the current single cell and its immediate environment. That environment may include one or more tiny virus cells near or inside the cell. It may also contain immunization tools that can be used to slow down or stop a viral attack.

There are four defenses against viral attack: interferon, which can be grabbed from an infected cell and spread to nearby healthy cells to (hopefully) stop the viruses from reproducing; macrophages, small green gobblers that can be used to chomp free viruses Pacman-style; B-cells, which divide to produce antibodies for protecting the blood stream; and committed T-cells that can be used like bombs to obliterate infected cells before the infection can spread.

The challenge is to choose the most appropriate type of defense, find the correct defense token in the grid, move the token to the optimum position and trigger the defense before it's too late. Since viruses may be attacking several parts of the body at once, it's often necessary to make rapid-fire strategic judgments.

Successfully defending the body against attack in multi-level games re-

quires several skills: the ability to think fast and make sound decisions under pressure; a strong memory for recalling the state of layers not currently shown on the screen; three-dimensional visualization skills for understanding relationships between adjacent levels; and, of course, joystick dexterity. It doesn't hurt to have a color monitor or TV, either. The graphics are excellent and color plays an important role in distinguishing different objects in this micro world.

The *Cell Defense* manual is cleverly designed to look like an old-fashioned science notebook, complete with hand-printed notes, cartoon drawings, and even a few doodles and tic-tac-toe games. It's surprisingly thorough and readable given its small (12-page) size. It's also supplemented by a series of reminder help screens that can be reviewed before any game. Even with these screens, most kids will probably need help from an older sibling to figure the instructions out, but a joystick-literate ten year-old should have no trouble playing the game once the ground rules are clear.

An opening menu allows the simulation to be adjusted in a number of ways. The number of cell levels, virus reproduction rate, cell regeneration rate and initial health of the host can all be adjusted to eight different settings. This increases the educational value of the simulation by allowing players to explore the effects of each of these variables. But it also gives the game added flexibility, so it can be fun for beginners and challenging for experienced defenders.

Cell Defense might be criticized as an oversimplification of the virus-host interaction, but the same can be said of any introductory text book description of that relationship. The truth is, scientists really don't know very much about what's going on at that level, and this program does a good job of illustrating the basic principles that they do understand. It's no substitute for biology lectures, textbooks or films. But in the classrooms or at home, *Cell Defense* offers an entertaining way for kids (and adults) to actively experience a little of the submicroscopic world inside. And as any educator can tell you, experience is a great teacher.

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The Print Shop

Computer: Commodore 64

Publisher: Broderbund

17 Paul Drive

San Rafael, CA 94903

Medium: Disk

This disk-based program from Broderbund is aptly named, since many of the applications you'd go to a typesetter and printer for can be handled with it. If you have a 64, a disk drive and a dot-matrix printer, then all you need is a copy of *The Print Shop* to start creating greeting cards, banners, letterheads, signs and screens.

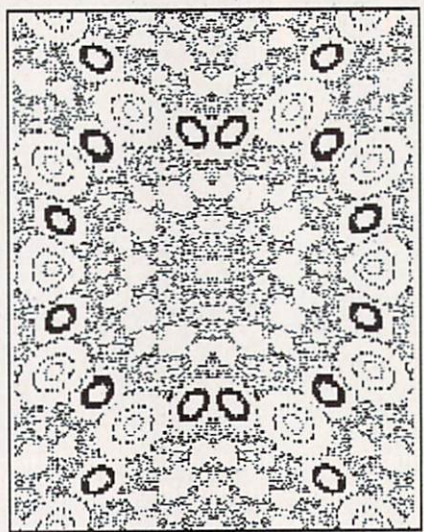
Broderbund has really done an outstanding job. Not only is the software itself superb and easy to use, they've also included a terrific user's manual that's packed with handy hints and great ideas for using the program. They've even included some fancy colored paper and envelopes to give your creations some extra pizzazz. The tractor-feed paper turns your *Print Shop* creations into something special. Included with the manual is a handy order blank for ordering more colored paper, envelopes and even colored printer ribbons.

The entire program is menu-driven, which always makes life a bit easier. The main menu allows you to choose from greeting card, sign, letterhead, banner, screen magic, graphic editor, or set-up selections.

When using *The Print Shop* for the first time, you must select the set-up option. This option allows you to custom-configure the program to match your printer type and interface so that everything works the way it should. A handy feature of the set-up is the ability to store your set-up data on disk. Once this is done, you won't need to use this option again unless you want to change it.

The program disk contains an assortment of 60 high-resolution graphics and patterns you may incorporate into your creations. The graphic-designs editor option from the main menu allows you to alter these graphics to your liking or create your own

If you have a 64, a disk drive and a dot-matrix printer, then all you need is a copy of The Print Shop to start creating greeting cards, banners, letterheads, signs and screens.



and save them to disk. Creating your own graphics and designs is easy to do by using the cursor keys, and a separate graphics editing menu provides you with the necessary commands. The size of the graphics may also be varied according to your layout and the size of your intended printed piece. Choices are given for small, normal or large graphics and various positioning options are also provided.

In addition to the library of graph-

ics contained on the disk, *The Print Shop* also provides you with a selection of eight type fonts to print the words on your creations. All of the fonts are in upper case only and the selection includes RSVP, Alexia, News, Tech, Party, Block, Stencil and Typewriter. Some of the fonts are larger in size than others, so by varying the fonts, you can have a combination of large and smaller wording on your projects. Another really nice feature is the ability to alter these fonts in the editing section of the program. You may print the font in solid, outline or three-dimensional (shadowed) form, adding even more impact and eye-appeal to your creations.

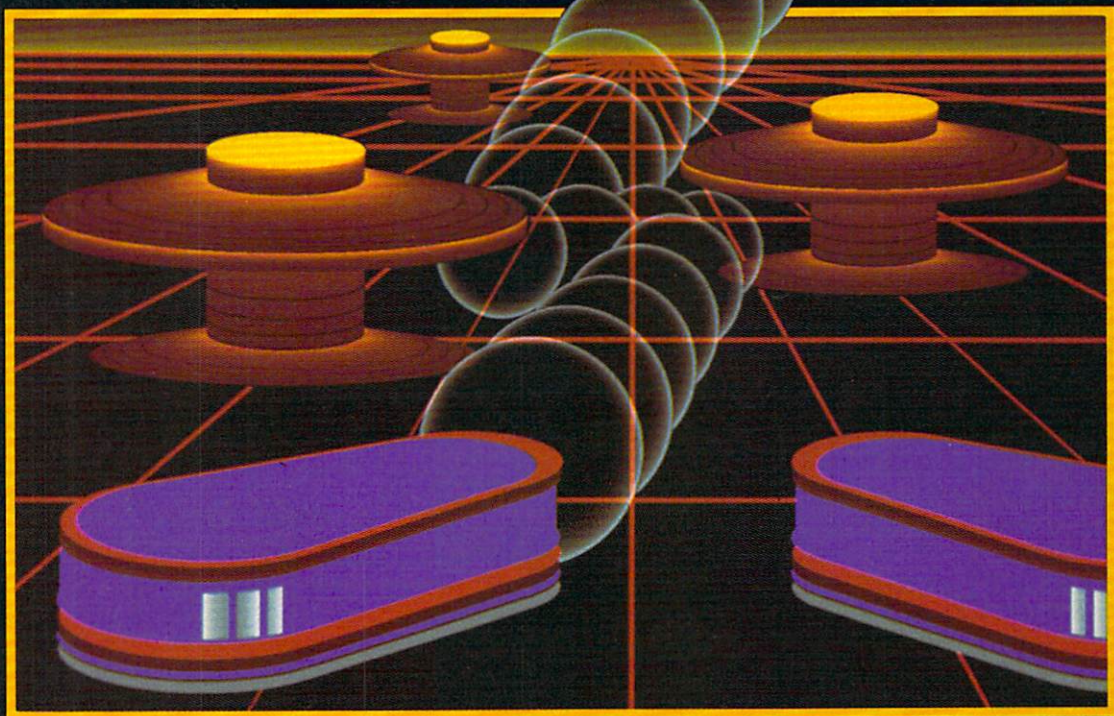
The 28-page user's manual supplied with *The Print Shop* is a work of art in itself. It is very complete. If there are any questions about using the program or what you can do with it, the answers will be found in this manual. Excellent documentation always adds to the enjoyability of a program.

I had lots of fun using the "screen magic" selection on the main menu. Screen magic is an assortment of kaleidoscopic designs and patterns also contained on the program disk, but on the other side of it. Kaleidoscope 1 is a selection of 11 pulsating patterns, while Kaleidoscope 2 is a continually-changing series of geometric shapes. In either mode, the screen can be "frozen" and printed out on your line printer. In the screen magic section, you may also draw text on the screen and get, save or print a screen, in addition to viewing the kaleidoscopes. The program leaves nothing wanting in the way of completeness.

The Print Shop is destined to become a perennial favorite with 64 owners, simply because it can do so much. I've never seen anything else like it available and I doubt that we will see anything more flexible, fun-to-use or practical to come for some time yet. It's one of those programs that allows you to use your equipment as a creative system; one that allows you to use the tools of modern technology while still making you the most indispensable ingredient—the creative one. It's a superb program that everyone in the house will enjoy and use—I give it my highest recommendation. C

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SkiWriter II

Computer: Commodore 64

Publisher: SkiSoft, Inc.
Prentice-Hall
Englewood Cliffs, NJ
07632

Medium: Cartridge

Simplicity, combined with speed, is always a strong selling point. However, true simplicity is defined in the mind of the user, not the designer. What appears sensible and sane to an author may not be considered so by the market.

SkiSoft, though, unquestionably did their homework before releasing *SkiWriter II*, a telecommunicating word processor, and it shows. Perhaps it's the experience author Ken Skier gained designing Wang's legendary word processing programs, or maybe the formidable marketing resources available to Prentice-Hall, a publishing giant now expanding into the home software market. Whatever it was, it works and works well.

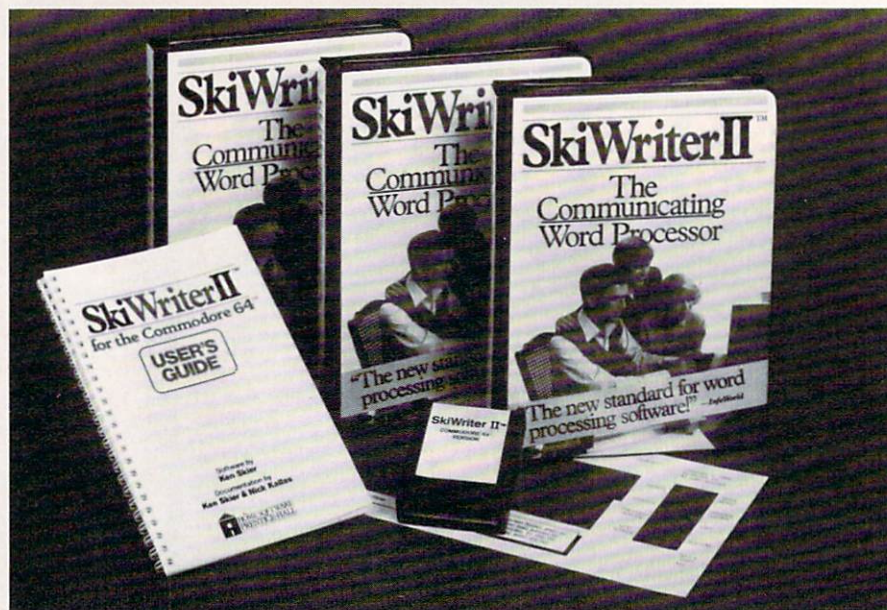
SkiSoft's decision to package their package as a cartridge was not simply a means of copy protection. According to Ken Skier, their motives were altruistic: a cartridge is less fragile than a disk, easier to handle and, perhaps most importantly, loads instantly.

Word Processor

The main menu moves you into the program's various modes. The main choices consist of eight self-defining functions: Edit (used before printing), Print, Use Cassette, Use Disk, Use Modem, Select Screen (colors) and Delete. Secondary menus evolve from each choice and they too are equally self-explanatory.

All basic text-processing functions are included: word wrap, move/copy text blocks, find/replace, format controls (by line, page or paragraph), end-of-page markers, plus numerous editing features such as overtype or insert modes, as well as disk and cassette control functions.

The Commodore key functions as an escape key. When you press the Commodore key then a number key, the text-processing functions are



available. And with the program's keyboard overlay, there's no need to memorize control codes.

Formatting is handled by "dot commands" and, as you may well suspect, they're so called because they start with a dot. Dot lines can be called via menu or, after you're familiar with the terminology, inserted directly. Also included is a Comment dot line. This, as the name promises, allows you to include unprinted remarks on the screen—the electronic equivalent of margin notes.

The eight dedicated function keys are also used to good advantage and, to the program's credit, not overused. F1 and F3 are the biggies. F1 is Cancel (that returns you to a prior menu), F3 is Execute (used in lieu of the RETURN key). The other six keys have functions assigned to them too, generally affecting screen control or page-at-a-time text movement. In Use Modem, the function keys have additional applications.

Printing is handled with the same sensible ease as is editing. Several options are available including using either a serial, parallel or Commodore printer. Incidentally, both the 1525 and MPS 801 printers are fully supported.

If your printer is in any way non-standard, just choose the Other Printer option. Answer the yes/no questions and the program configures itself for your printer/interface combi-

nation. All the tsk-tsking about the computer industry's rampant non-standardization becomes practically irrelevant, as a result. If you can't find a menu choice supporting your printer, then your set-up belongs in Ripley's.


The manual is a delight, an outstanding example of the three C's: concise, clear and compact. Hardly a spellbinder, but thankfully brief and direct. In five fast-reading, short chapters, all the program's aspects are painlessly explained. In fact, the self-evident menus combined with the keyboard overlay are sufficient for diving right in, especially if you have a sense of adventure.

Telecommunications

Not content to just design a super-fast, supersimple word processor, SkiSoft went the distance and integrated a telecommunications program, too. And when I say integrated, I mean *totally*.

Branching from the main menu's Use Modem option, you can choose from seven subsequent entrees including Up or Download Files, plus three ways of getting on-line. The three ways to get on-line are:

Terminals: the standard telecommunications protocol. Use this mode to speak with the Source, CompuServe or any of the nearly 3,000 other public and private data bases now available.

Despite this relatively minor omission, *SkiWriter II* is a superb word processing/telecommunicating program for the 64—easy to learn and easy to live with. Incidentally, I've paid *SkiWriter* the writer's ultimate tribute: I've abandoned my old familiar word processor and adopted this one. Times are changing and *SkiWriter* is too good to overlook. 

Your Home Office

Computer: Commodore 64

Publisher: Tri Micro

1010 N. Batavia, Suite 6
Orange, CA 92667

Medium: Disk

Your Home Office is an integrated word processor and electronic spreadsheet. Tri Micro has taken the experience they gained creating the Plus/4's integrated, built-in software and applied it to the king of micros, the Commodore 64. As a marriage of convenience and value, the program succeeds handsomely.

The entire manual consists of a mere 43 pages, just enough to keep you busy on a train ride from Bridgeport, Connecticut, to New York City. Don't be fooled by the diminutive size though, everything's covered in sufficient detail.

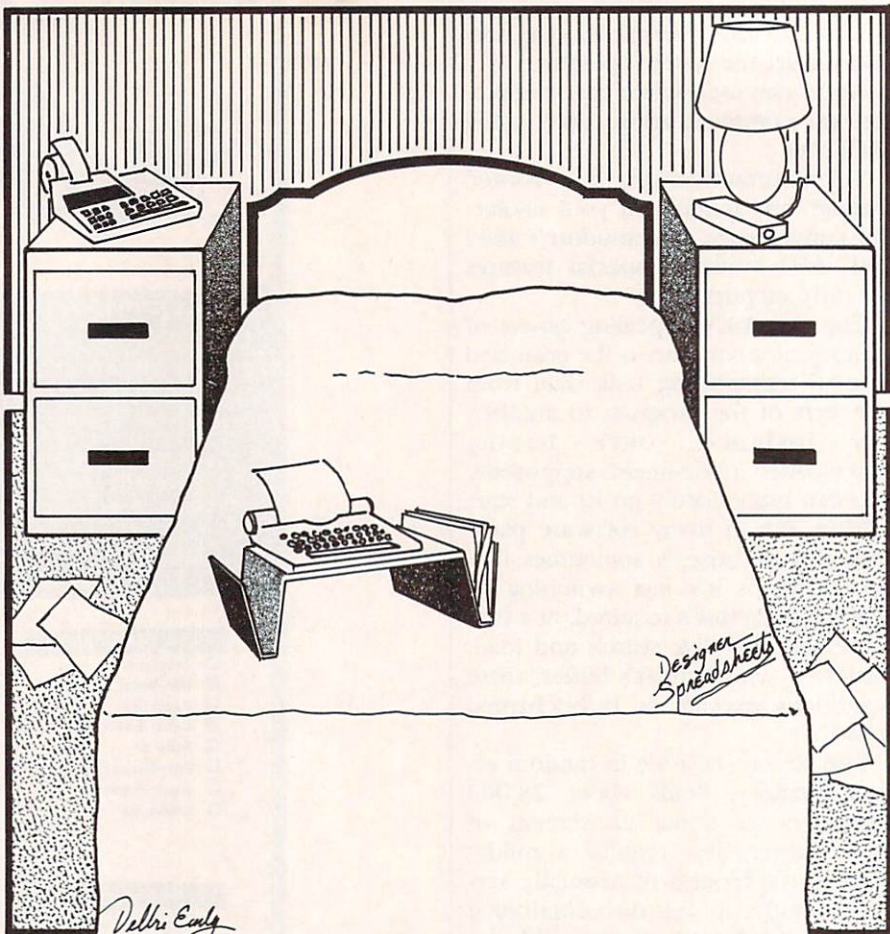
Four pages of quick reference cards explain the spreadsheet, word processor and printer format commands. After a short briefing on the program's power and a list of needed hardware, the guide then provides data disk formatting instructions. Once that chore's been taken care of, *Your Home Office* beckons.

The spreadsheet handles most common duties with speed and efficiency. It's capable of many geometric, logarithmic, and exponential functions as well as the standard mathematical operations. It even handles conditional statements.

Three command modes permit entry of text, formulas and numeric data. Cursor control is accomplished with the up/down CRSR key, F7 for right column and F8 for left column. This scheme works surprisingly well.

The spreadsheet's 50-row by 17-column size is more than enough space. Even the limited display of 12 rows by three columns isn't as much of a hindrance as it first appears. Data and formulas can be copied for movement to other cells and labels can be repeated.

There is an automatic recalculation mode which makes it easy to perform



"what-if" scenarios. This modeling power can be very helpful in forecasting trends, determining quantities required or in costing.

Sometimes you don't want certain cells to be recalculated. In that case, there's a "freeze" command which prevents further operations on designated cells. "Thaw" reverses the command as needed. For jobs requiring manual manipulation of data, the auto function can be switched off with just a few keystrokes.

It's also possible to catalog the disk, format a blank, delete files and load files from within the spreadsheet. Automatic justification of text and numerals can also be overridden.

An IFTRUE command permits complex expression evaluation, something many users will never need to explore. Besides absolute values and integer, dollar, and floating-point formats, the spreadsheet can handle sine, tangent, arctangent and cosine functions.

In addition to the merge capabilities, it's also possible to view the spreadsheet and the word processor

simultaneously. Windowing is also featured.

Though Tri Micro's spreadsheet possesses impressive features, the program's true versatility and power comes to light only after the word processor's functions are understood and properly utilized for specialized report generation.

Perhaps the most important part of the word processor is cursor control. Besides the usual CRSR and RETURN keys, *Your Home Office* provides other ways to maneuver. Hitting F7 transports the cursor to the right of the page while F8 does the same for the southpaw side. The CLR/HOME key sends the cursor to the top of the file while the SHIFT CLR/HOME does the same for the bottom.

Last but not least, [CTRL/left arrow] sets tabs and the left arrow key moves the cursor accordingly. For convenience, *Your Home Office* pre-sets a tab at line 77. But for this final column setting, all tabs are displayed at the bottom of the screen on the program status line.

Continued on page 114

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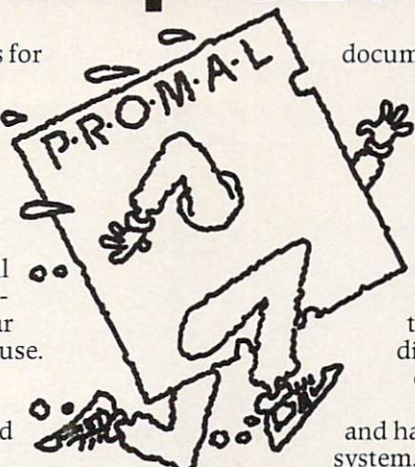
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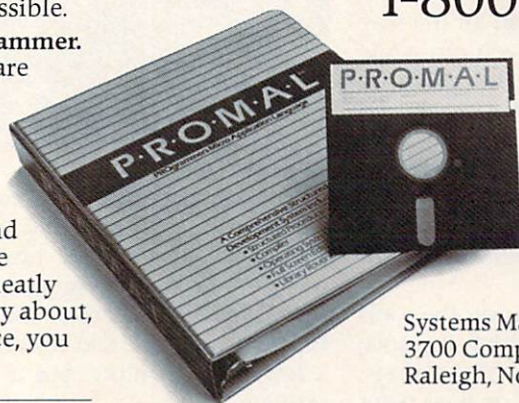
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Object Code Size (bytes)	128	255	329	181	415
Program Load Time (secs.)	3.2	3.8	6.3	11.2	23.5
Compile Time (secs.)	8.5	—	—	3.9	108

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Logic Levels and Memory Manor

Computer: Commodore 64

Publisher: Spinnaker

One Kendall Square

Cambridge, MA 02139

Medium: Cartridge

A logical mind and a good memory are valuable assets in our world today, but can young children be motivated to learn how to reason effectively and to exercise those brain cells controlling memory? Software developer Frieda Lekkerkerker thinks so and she's recently created two colorful and exciting Fisher Price learning games for children.

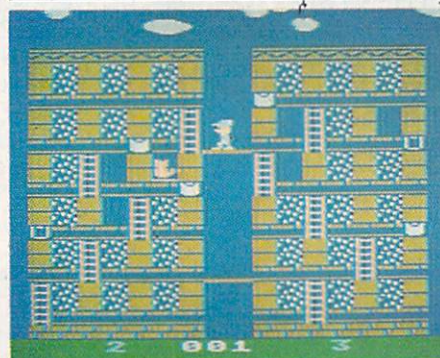
Logic Levels

Logic Levels is comprised of a maze through which your little ball bounces pinball-machine style. The object of the game is to get the ball all the way to the bottom as fast as you can while earning points. Begin the game by making no changes to the scene and merely letting the ball run through its paces. By doing so, you'll see the problems you must later avoid. For example, you'll need to put up walls so the ball won't fall through the side of the maze.

Now play the game using the tools available. Use your joystick to move the magic hand to the walls, springs, bridges, or red, yellow or blue paint bucket icons at the top of your screen.

Move the hand to the desired object, press the joystick button and you'll see the fingers moving to grasp it—good graphics. Move the hand with its object to the maze and press the button to release the object where you want it. (If you change your mind before pressing the joystick button—say you really don't want to use a spring—you're still safe. Just move the object back to the box at the top of your screen and put it in there. It'll reappear for later use.)

Throughout the maze you'll see hearts, stars and other colored symbols. These are prizes to gain points.



Memory Manor

There are also tactics to earn extra points. For example, if you arrange the maze so the ball hits a paint bucket—say the yellow one—and it then hits a yellow prize, you get double points. You're also rewarded with a few bars of music and a dramatic flashing screen.

Use the joystick button to make your springs leap up or compress and to make your ball jump up a level. Use the bridges to force the ball to bounce against a red paint bucket and then a red heart. (Double points, remember?) Then move the joystick left or right to open up the bridge.

Each game has two rounds and you can give yourself a time limit—an "energy" bar which steadily decreases once you begin running the ball through the maze. (If you do well, you'll get more energy!) My six year-old son decided he'd prefer all the time he needed, so he erased the time limit using the F3 key. Then I called it

Logic Levels

back later, pressing the key again.

How can *Logic Levels* enhance a child's reasoning skills? You must decide where to place the bridges, springs and wall to maximize their points. Once you've learned how to get the ball to the end of the maze, your next goal is to figure out how can you earn more points—what configuration will do it for you? Is it better to have the walls closer in or to place them at the very end of the side of the maze? (Make sure there's an outlet for your ball to go down or you can get stuck on one level.) Do you want to use most of your tools or save them for later? The game rewards planning and recognizing cause-and-effect relationships.

Of course the maze changes slightly with each play, so you'll have to carefully observe what layout you're given and think how you can best "fix" it.

Logic Levels is a highly interactive, creative game and I agree with Fisher Price that it's ideal for children ages six through 12. (A lot of fun for Mom or Dad, too!)

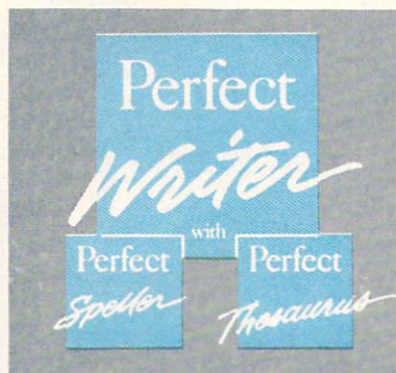
Memory Manor

Memory Manor is another learning game but with the unusual theme of washing windows! You're in charge of Wee Willie the window washer-man and your goal is to wash the win-

Continued on page 115

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Menuwriter

Computer: Commodore 64

Publisher: Codewriter Corporation
7847 N. Caldwell Avenue
Niles, IL 60648

Medium: Disk

Menuwriter is a code-generating system from Codewriter that helps you create automatic menus that link related (or unrelated) application programs and makes them easy to load and run. *Menuwriter* also has the power to link a menu with up to 20 additional separate menus, each of which are created by *Menuwriter*.

Here is just an example of what you can do with *Menuwriter*: create a menu that gives you options to load and run a series of business-related (or otherwise) programs to organize your finances or inventory, keep track of tax information, do word processing, organize travelling expenses, or virtually any information processing that you need. A single menu written by *Menuwriter* can contain up to 15 options, which can include linking up with additional menus. All of this and you don't have to write a single line of BASIC. The only commands required are load, save and verify.

What do you get for your money? You get a single disk, which contains the needed software and an instruction manual, which includes a tutorial on program use in a nice book-style protective binder.

How does *Menuwriter* work? After loading the main program, you are prompted through the process of creating a menu to your own specifications. At every step along the way, you are provided with prompts to keep you on task and prevent you from getting lost. Each step of the overall process displays your options at the bottom of the screen. You can opt for loading the programs as they are named on the application disk or you can give them new names (on the menu) that are more descriptive of their purpose, and there is no need to re-name the programs on the disk. The menu program will keep all of that straight for you. There is even a list of some standard miscellaneous options for you to choose from and

Create a menu that gives you options to load and run a series of business-related (or otherwise) programs to organize your finances or inventory, keep track of tax information, do word processing, organize travelling expenses.

add to your custom menu: set display colors, read a directory, format a disk, go to the master menu, go to the last menu and exit to BASIC.

The results of your creative efforts will be an easy-to-use, spiffy-looking (if you so desire) custom menu that will allow the user to load a program or move through a series of related program operations with ease. A single keystroke can load a directory, format a disk, or load and run a program. No more typographical errors to worry about. No more "load errors" or "file not found" messages. The menu program takes all of the work and worry out of finding and loading your BASIC programs.

The manual is written in Codewriter's consistently easy to follow, step-by-step tutorials. Each page has a margin containing visual prompts to aid in the menu creation process. The instructions in the tutorial are clear and precise. The tutorial is complete and easy to follow for the most part.

The only shortcoming that I found in the tutorial was its reference to application programs that were generated using other Codewriter products. All of the allusions to program names presume that the programs were created using their other code-generating



products. I found this to be a little confusing and ambiguous. Once you overcome this (mental) hurdle though, things run very smoothly.

Codewriter offers a very liberal and complete warranty and customer support system. The warranty for the disk itself is for one full year, even if your pooch takes a bite out of it. Any upgrading that the manufacturer performs on the software is available free to registered owners. They didn't mention any automatic notification of this, so I presume that you would have to request an update. There is a toll-free customer service number and a back-up copy of the disk is available for a nominal fee. You also get a personal I.D. number with your warranty registration card.

Overall, the *Menuwriter* package is an effective, easy-to-use system. It will undoubtedly make life around the home (and small business) computer room a lot easier by virtually eliminating program location and loading problems. All you have to remember is LOAD "MENU". It's a snap to learn and has tremendous power and lots of applications. The more you use it, the more often you'll want to use it.



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The Flash! is a permanent firmware installation in your Commodore 64 and 1541 disk drive. It has both a software (ROM) and a hardware component.

■ **It's Transparent**
Best of all, the 1541 Flash! is transparent. Computer operations all remain unaffected as it speeds up every disk-related function. And there is nothing new to learn for the Flash! No special tricks or techniques. Once it's in, just watch it go. We have tested it on well over one hundred programs and it loads spectacularly fast.

■ **It's Flexible**
And it's flexible. The 1541 Flash! adds 21 extra commands for the Commodore 64 user. These include a built-in "DOS WEDGE," eight editing commands, a couple of easy loading commands, and fast-transfer commands for the advanced programmer. Here is an example of what it can do: For programs that usually load with a "1000 8.1" command, just hit Shift/Run-Stop. A large spreadsheet program like **BUSICALC-3** then loads in about 25 seconds. Through keyboard commands or a hardware "off" switch, you can even return to the old, slow loading method, if for some reason you really want to. Or you can ignore all its commands, and just enjoy the speedy disk operations.

■ **It's Serious**
But if you are really serious about programming, the 1541 Flash! is a gold mine. For example, the manual will show you how to write software allowing data transfer to and from the disk drive at speeds up to 10 times the normal.

■ **It's Easy**
Installation of the 1541 Flash! consists of plugging a small assembly inside the Commodore 64 and two small assemblies plug into the Commodore 64s, no soldering is required. Assembly instructions include detailed pictures and drawings. And installation is—well, a flash.

■ **It's Available**
Call Skyles Electric Works to place your order or to get more info on the 1541 Flash! Hurry up, though. They may be gone before you know it.

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The Dialog System

Computer: Commodore 64

Publisher: Codewriter Corporation
7847 N. Caldwell Avenue
Niles, IL 60648

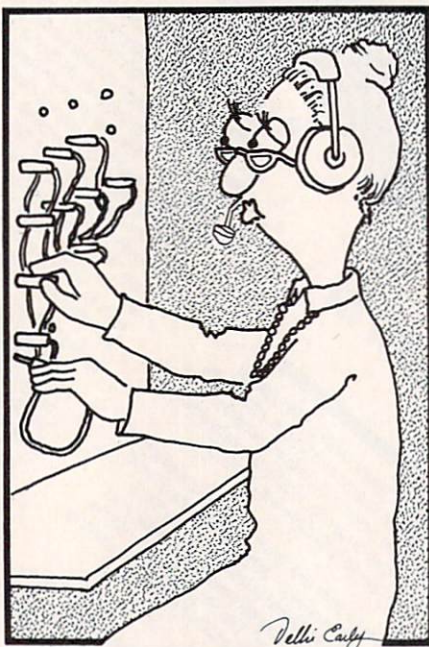
Medium: Disk

Once again, Codewriter has produced a piece of high-quality programming software for the non-programmer. This time, the application is more specific than the company's multipurpose program generator, *Codewriter*, and more flexible than their *Elf System*. Coming to the aid of parents and educators, *Dialog* is a program-generating system to be used in the creation of custom-built educational programs. You, the program designer, decide how the activity is to flow. You decide what kind of responses the program will present to the end users, your students or children. You decide how difficult the activities will be. All of this power and you don't need to write a single line of BASIC code! *Dialog* does all of the coding for you.

When you develop a program or activity (called a chapter) with *Dialog*, you will be able to create up to 15 pages of text. Accompanying each page of text is a parameter page. The text page is what the end user will see, while the parameter page will contain instructions as to how the text page is to be presented and how responses are to be evaluated. There are five possible kinds of responses from which to choose. They are multiple choice, fill-in-the-blank, sequential, true/false and memory. You can mix and match any of these sequence types in your program as you see fit. This gives you great flexibility and variety.

Some of the things you can control are screen, border, text colors, messages to the user, whether or not to provide hints to the user, whether or not to keep score as well as where to keep score. Another feature that adds great power to *Dialog* is the ability to control the flow of the program. For example, in a multiple-choice question, you can provide a different re-

Dialog is a program-generating system to be used in the creation of custom-built educational programs.



sponse for each of the incorrect answers, then direct the user back to the original question for another try (keeping score along the way if you so desire).

In a fill-in-the-blank type response, you will specify a word or words as a correct answer. When the user responds, *Dialog* will search the response to see if it contains the information that you had established as an acceptable answer. If the user response contains that information, then *Dialog* considers it a correct answer.

The simplest type of parameter page is the sequential type. This type merely gives the user a particular amount of time to read the text screen, then progresses to the next screen. In the true/false parameter page, the user need only answer "T" or "F" and the parameter page passes control to whatever you have specified as the next appropriate page, depending on the response. These var-

ied methods of controlling program flow provide variety as well as flexibility in program design.

On top of all of this, *Dialog* offers some powerful bonus features. The user can stop anywhere during the course of the session and save the activity. Later, the user can load *Dialog* and pick up where he or she left off. Also, you can print out your *Dialog* after its creation. When doing this, you can select any number of pages (text pages, parameter pages, or both). Another nice feature is the ability to call up another chapter from the disk. This is called "linking" and can be very useful if you are creating a very long *Dialog*.

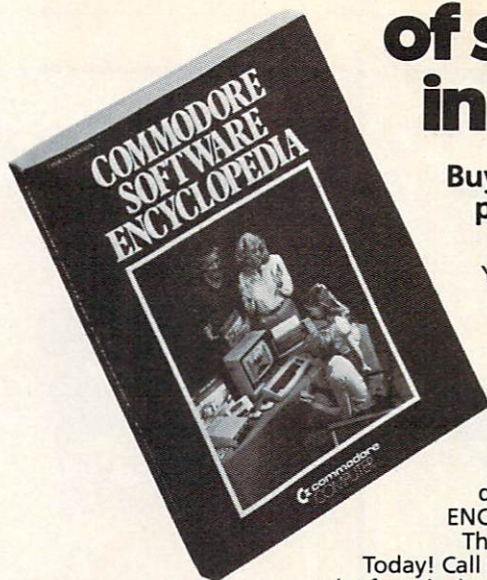
The instruction manual is very complete and well structured. As with most of Codewriter's products, each page contains a border in which you will find prompts to aid in the development of your *Dialog*.

The manual contains two tutorials to get you accustomed to the system. The first tutorial merely acquaints the program designer with the layout and functions of the parameter and text pages. The second, or main, tutorial is larger and provides a complete run-through of each of the five sequence types, allowing the designer to create a sample *Dialog* from start to finish. The main tutorial is completely documented in the manual, leaving no margin for error.

It's interesting to note here that the main tutorial was written using *Dialog* itself! This attests to its power and flexibility. Also included in the manual is a handy reference section. This is useful in that you can select a particular operation of *Dialog* for study and review.

Dialog is a truly mighty program-generating system. But beyond that, *Dialog* provides you with the opportunity to write interactive programs, rather than the cut-and-dry passive programs that currently flood the marketplace. It allows the end user to interact with the program instead of just reading the screen. This interaction promotes learning and keeps the user interested and alert. I doubt that any other software on the market can make the same claim and live up to it in the same fine tradition of Codewriter.

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Creative Writer/Filer/ Calc

Computer: Commodore 64
Publisher: Creative Software
 960 Hamlin Court
 Sunnyvale, CA 94089
Medium: Disk

Everyone has been jumping on the integrated software bandwagon these days. Approaches range from single software packages containing word processing, database and spreadsheet components, to ROM-based firmware and programs designed to either stand alone or work together. Whatever method is used, the watchword is versatility.

The Creative Software series consists of three packages: *Creative Writer* (word processing), *Creative Filer* (file manager) and *Creative Calc* (spreadsheet). Whether used individually or as an integrated package, these programs exhibit numerous strengths and very few weaknesses.

Because they are completely menu driven, I found them easy to master. This was true despite their wide range of capabilities. Compared to equivalent software (on a dollar-to-dollar basis), this set is hard to beat!

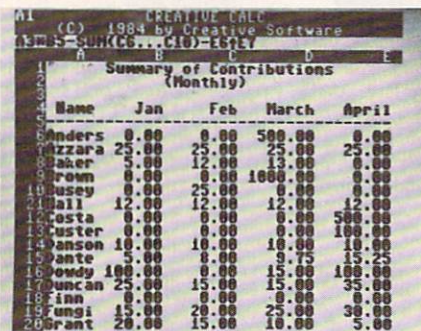
The manuals are well organized, particularly those for *Calc* and *Writer*. The *Filer* instruction booklet is more difficult to get through due to the two dozen (plus) command and control errors it contains. These, however, are corrected on an enclosed errata sheet. (Once the miscues are transferred to the manual itself, the amount of time spent being bewildered and the number of mistakes committed decreases dramatically.)

Each guide contains a table of contents and a complete index. Common topics include necessary hardware, manual conventions and program capacities. Having this data up front eases startup considerably.

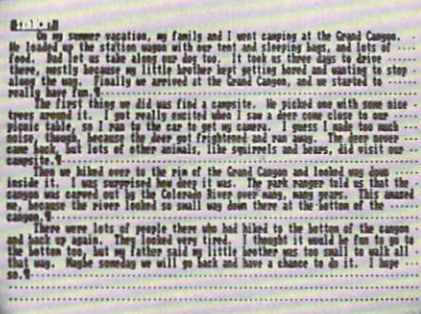
Creative Writer

Since the series is built around the word processor, let's begin there. (Some of the report generation and

These three programs can be used individually or as an integrated package.



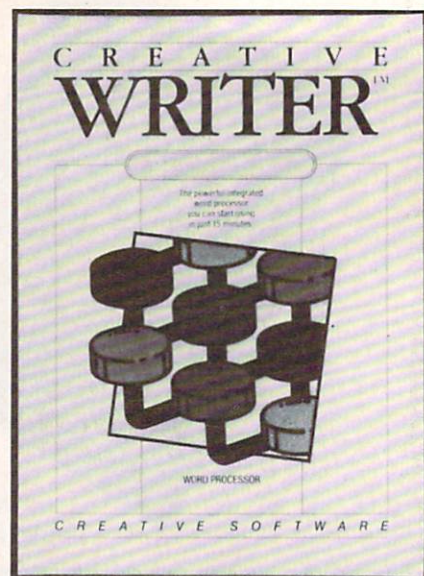
Name	Jan	Feb	March	April
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Baker	5.00	12.00	13.00	0.00
Brom	0.00	0.00	1000.00	0.00
Busey	0.00	25.00	0.00	0.00
Dall	12.00	12.00	12.00	12.00
Costa	0.00	0.00	0.00	500.00
Custer	0.00	0.00	0.00	100.00
Danson	10.00	10.00	10.00	10.00
Dante	0.00	0.00	9.75	15.25
Dewdy	100.00	0.00	15.00	100.00
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On my summer vacation, my family and I went camping at the Grand Canyon. ...
 He loaded up the station wagon with our tent and sleeping bags, and lots of ...
 food. And let us take along our dog too. It took us three days to drive ...
 there, mostly because my little brother kept getting bored and wanting to stop ...
 along the way. Finally we arrived at the Grand Canyon, and we started to ...
 really have fun. ...
 The first thing we did was find a campsite. He picked one with some nice ...
 trees around it. I got really excited when I saw a deer come close to our ...
 picnic table, so I ran to the car to get my camera. I guess I made too much ...
 noise, though, because the deer got frightened and ran away. The deer never ...
 came back, but lots of other animals, like squirrels and bears, did visit our ...
 campsite. ...
 Then we hiked over to the rim of the Grand Canyon and looked way down ...
 inside it. I was surprised how deep it was. The park ranger told us that the ...
 canyon was carved out by the Colorado River over many, many years. This amazed ...
 us. Because the river looked so small way down there at the bottom of the ...
 canyon. ...
 There were lots of people there who had hiked to the bottom of the canyon ...
 and looked up again. They looked very tired. I thought it would be fun to go to ...
 the bottom too, but my father said my little brother was too small to walk all ...
 that way. Maybe someday we will go back and have a chance to do it. I hope ...
 so. ...

database merge capabilities in the other two programs are accessed through *Creative Writer*.) From the main menu, it's possible to clear memory, save, load, write or delete documents with just a few keystrokes. Other options include page formatting, output preview, printer output, and file and disk handling utilities. As needed, each of these contains submenus for customized output and increased flexibility.

Cursor movement is nearly identical to the keyboard functions. INST/DEL, CLR/HOME and CRSR keys work as they do when you are entering BASIC programs. Blank line insertion and deletion is accomplished with the INST/DEL key when the cursor is on a blank line. SHIFT INST/DEL allows for text insertion (without overwrite) in the body of any document and F1 and CLR/HOME move the cur-



sor to the bottom and top of the document respectively.

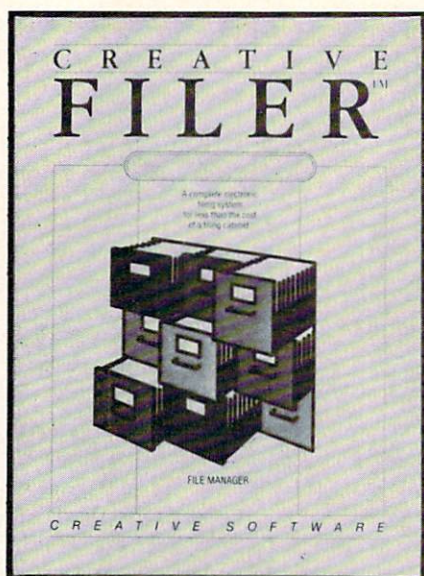
Though text display is limited to 40 columns, the preview document screen shows the output format through a graphic rendition of the page. In other words, lines are used to show text placement, although the text itself isn't depicted.

Printer output options include number of copies desired, automatic pagination (starting at a designated numeral), a pause feature for paper and font changes, and the choice between Commodore and standard ASCII output.

Paper width and length, margin set, justification, centering, header/footer placement and line spacing are all easily altered. Besides blank disk initialization, the utility functions provide horizontal and vertical print tests. Additionally, the word count, number of lines used and space remaining (for any document in memory) can be had at the touch of a single key.

Text can be deleted by the word, line, sentence or paragraph. Thanks to the 20-line buffer, it can also be restored painlessly in case of an error. Beyond this there's a 200-line copy/move text buffer for text realignment and alteration. Combine these advanced features with a string (up to 32 characters) search and replace function and *Creative Writer* becomes a very powerful processor indeed!

Imbedded print commands include force new page, tab control and a



keep function which eliminates widows and orphans. Nonprinting comment lines (like REM statements in BASIC) serve as electronic memo pads in the midst of the specified document.

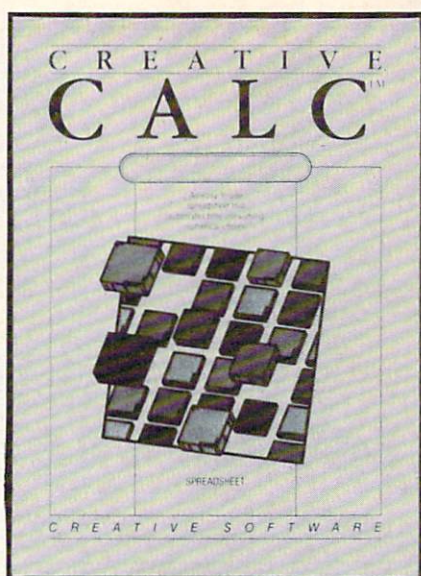
Variables are inserted as needed or desired to access the special files created by the other programs. *Creative Writer* will load these from document disks, merging them with form letters or reports. It's also possible to link lengthy documents, thereby skirting the already generous 700-line-per-document limitation.

Creative Writer provides functions and features not usually found on word processors going for less than \$300. At a mere \$49.95, it's quite a steal.

Creative Filer

Creative Filer's main menu options include form design, data entry, search/modify entries, and report writing. An erase capability, disk catalog and exit to BASIC round out the selections. This program can handle an unlimited number of files, each containing up to 100 fields per record with titles or field names comprising as many as 20 characters each. There's no limit to the number of characters permissible per record.

Record alteration, review, and output preparation are quite easy. Most applicable commands are issued with the function keys or CTRL keystrokes. The latter are mnemonically structured; that is, CTRL D deletes a line while CTRL I inserts one.



Creative Filer admits to not having the power of a *DBase II* or the like. The plus side, however, is its ease of use and access to the most widely used (and needed) functions. The majority of homeowners and small businessmen will find it more than adequate for their current and future needs.

Searches are conducted on a primary or secondary field. The first established field automatically becomes the primary, so plan well. (Users designate the secondary field.) Report generation can be customized to include or leave out any fields. Fields themselves may be truncated or printed in toto. Page formatting includes date, page and text length as well as pagination and automatic columnation capabilities.

Probably the most powerful set of functions comes under the "derived fields" heading. Users combine (arithmetically) any fields they desire. Addition, multiplication, subtraction and division are supported. Numerical entries in fields like cost of goods, number of units sold, and operating expenses can be manipulated with these functions. Best of all, the program alerts you to any illegal entries, making it impossible to continue until they're corrected.

In addition to direct printer output of data, the program also saves fields to disk for access by variables established in *Creative Writer* files. You can have it both ways for a minimum of effort and money.

Creative Calc

Now we move on to the most powerful and (generically speaking) the least understood program used by non-professionals: the electronic spreadsheet. Useful for forecasting sales trends and parts requirements, budgeting, modeling "what if" scenarios and straight-out costing, these packages also evoke more fear and misunderstanding than the "dreaded" data base.

Creative Calc is limited to 255 rows and 64 columns, making the number of cells available a shade over 16,000. The number of worksheets that can fit on a disk is determined by the size of each.

Users can alter the screen's color-coded menu, cursor and comment line to ease eyestrain. Text, numerical values and formulas are input by hitting RETURN or moving the cursor. (The entry edit cursor is controlled with the F5 and F7 keys.) the CRSR keys, CLR/HOME and a GOTO function permit flexible, speedy cursor control. Additionally, F2 moves the cursor up a page, F4 moves it down one, and F7 and F8 send it left and right, respectively.

A brief tutorial explains mathematical precedence and the use of parentheses for the uninitiated. Don't worry about feeling stupid, *Creative Calc's* manual is helpful without being condescending.

Through this setup, *Creative Calc* allows cell, row and column erasure, copying, output to printer and recalculation. Row and column insertion, and relative and constant formula replication are included, as well as disk manipulation (save, scratch and display files).

Global or single-cell formatting of text or value inputs, decimal positioning, and windowing are also part of this impressive package. Besides the standard mathematical operators, *Creative Calc* supports sine, cosine, arctangent, base ten logarithms, absolute values, exponentiation and automatic column/row summation.

These brief "walk throughs" should demonstrate the value, power and flexibility Creative has packed into these Commodore 64 programs. Once again it must be noted, these packages are excellent whether used individually or as a set.



Pascal 64

Computer: Commodore 64

Publisher: Abacus Software

P.O. Box 7211

Grand Rapids, MI 49510

Medium: Disk

Pascal 64 by Abacus Software allows the user to create source files (programs written in high-level language) by using the BASIC editor. The programs are then compiled (translated into machine language), saved and run. Of course, the final product, consisting of machine language code, runs many times faster than a similar BASIC program. But this is merely one advantage of using *Pascal 64* in place of BASIC, as we shall see later. *Pascal 64* contains many features which allow the user to take advantage of the high-resolution graphics, sprites and disk-file management of the 64.

There are many differences between Pascal and BASIC, apart from the fact that the former is compiled while the latter is interpreted. Commodore users who have learned and used languages such as FORTRAN, ALGOL and PL/1 will find the logic and syntax of Pascal easy to learn. Those users who have been exposed to BASIC alone will need to be more careful with commas, spaces, colons and semicolons, because the syntax of Pascal is somewhat different from that of BASIC. This is a small sacrifice for the opportunity to adapt this powerful tool to the 64.

Pascal is a structured language. The programs consist of blocks which can be nested as shown in Figure 1. Global and local variables can be defined this way. The nesting can be shown in the program listing by properly indenting the blocks.

Procedures in Pascal allow one to pass variables as arguments. This enables the programmer to use the same procedure many times with different variables. This also applies to user-defined functions. For example, a procedure, named CALC would be declared by

```
PROCEDURE CALC
  (VAR A,B,C:REAL);
```

This procedure defines (locally) the

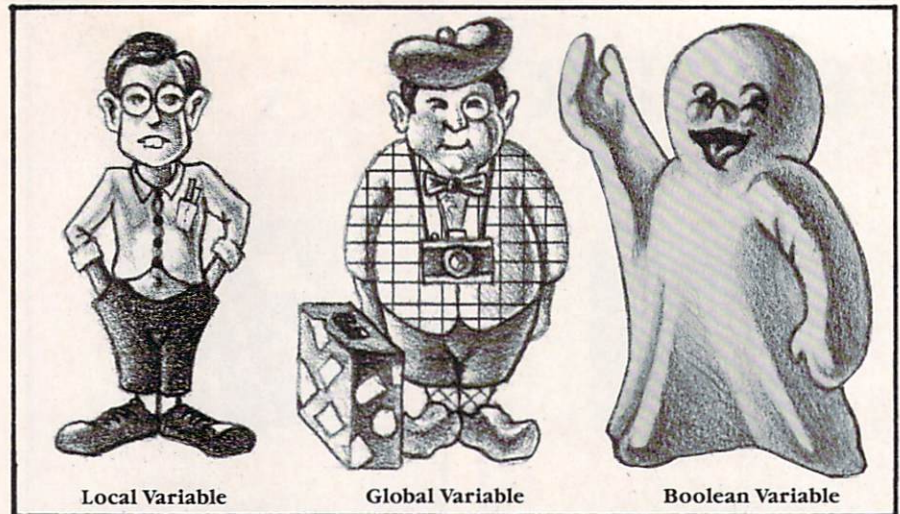


Figure 1. Nesting of Blocks

```
...
BEGIN (block1)
...
  BEGIN (block2)
  ...
    BEGIN (block3)
    ...
      END (block3)
    ...
  END (block2)
  ...
  BEGIN (block4)
  ...
    END (block4)
  ...
END (block1)
```

variables A, B and C, all of which are real. Assuming that the user has created the procedure, that is, it computes $C := A/B$, one can call the procedure by the statement

```
CALC (X,Y,Z);
```

Of course, the operation defined within the procedure, $C := A/B$, is performed on the arguments X, Y, and Z ($Z := A/B$).

A library of general-purpose procedures can be created and it is possible to include members of the library within a program. But, one may also use external libraries and call them like we do with built-in commands and functions. A procedure or function can call itself, thus recursion is easily achieved.

Pascal recognizes Boolean variables (variables to be tested as true or false) in addition to integer, real and character variables. It even allows the user to

define his own data types. Pascal provides additional functions which standard BASIC does not include, that is, the successor and predecessor of an integer variable. Variables which obtain fixed values can be declared as constants.

In Pascal it is possible to create sets, which are collections of elements of the same type. Set operations are useful for simplifying complicated comparisons and for other purposes (the interested reader should refer to a text on set theory). Another data structure is the record, which is a unit consisting of several different data types (characters and numbers) that are difficult to represent in a single array. Pascal offers the option to save memory by using packed arrays for Boolean variables in this version.

Loops in Pascal can take several forms. For example, REPEAT... UNTIL..., WHILE... DO..., and FOR... TO... DO... Conditional statements can be of the form IF... THEN... ELSE..., or CASE... OF... END. GOTO statements use labels rather than line numbers, which is advantageous in many circumstances.

One of the benefits offered by Pascal is dynamic memory allocation. By using pointers, it is possible to insert or delete elements of an array without affecting the position in memory of other elements. There are many other features of Pascal which cannot possibly be reported in this brief review.

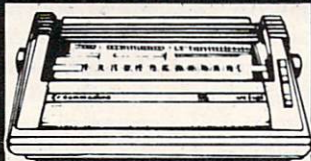
Pascal 64 provides means for file management, including relative files.

Continued on page 116



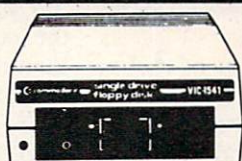
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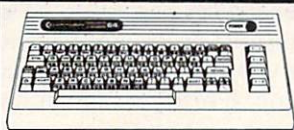
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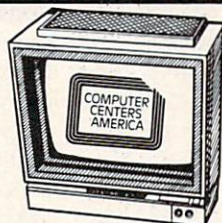
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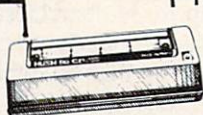
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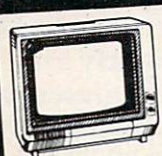


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Apply Yourself with PROMAL

A New High-level Computer Language for the Commodore 64

What looks a bit like Pascal, operates a bit like C, and has nothing whatsoever to do with COMAL? It's a new computer language called PROMAL, or PROGRAMMER'S Micro Application Language. Designed by Bruce D. Carbrey, PROMAL is marketed by Systems Management Associates as an end-user system for \$49.95, or as a developer's system (for stand-alone programs) for \$99.95.

Give Your Computer a Facelift

There are many ways to overhaul a computer. You can change the display or add a numeric keypad. You can rip out the guts and replace them with a coffee grinder (a Christmas gift for the person who has everything, perhaps). You can be almost as radical, and a lot less destructive, if you merely replace the operating system and BASIC language on your Commodore 64, and make it *think* that it's a whole new machine.

This is not as simple as it sounds. Not only is a new computer language in order, so is an operating system (for dealing with the disk drives, printer and so forth) and some kind of editor (to modify programs and files). While augmenting your Commodore 64's built-in software is like adjusting the carburetor on a car, replacing the software is like replacing the engine. However, in this case, the new "engine" gives your Commodore 64 a new kind of power.

Although it is not possible to completely cover the PROMAL system here, I will try to give you an idea of its "flavor," and what it can do.

PROMAL is a total system, with an operating system and an editor included on the disk with the PROMAL language. Although all of these pieces

are very well integrated, it is possible to talk about each item separately. First, let's look at the PROMAL language.

Exterminate Those Unsightly Line Numbers And GOTO Statements

PROMAL provides many of the essential features of an application language, and enough power to write text editors, compilers and operating systems. In fact, most of the PROMAL system itself is written in PROMAL. Yet, with all this power, it is still very easy to learn. Table 1 and Table 2 show its simplicity.

PROMAL bears a distinct resemblance to Pascal, but avoids many of Pascal's problems. For example, Pascal generally recognizes only the first eight characters of variable, program and procedure names. PROMAL allows up to 31 characters, all of them significant. Underlined characters can be used in names, which is a nice touch. And PROMAL provides an ELSE clause for its version of the Pascal CASE statement (CHOOSE). (Pascal has no ELSE!)

A PROMAL program is written like a Pascal or C program, with global variables and constants defined first, then all procedures and functions, and finally the main program at the end. The example program in Listing 1 shows how structured program writing is enforced. Unlike Pascal or C, however, only one statement per line is allowed and blank spaces are required between key symbols and names. Since the programs are compiled, this doesn't affect memory use.

PROMAL's key requirement is indentation of lines, which the compiler recognizes as part of the structured syntax for loops and conditional statements. This makes PROMAL extremely readable, and eliminates EN-

DIF, ENDWHILE or similar keywords. On the other hand, a NOTHING keyword must be defined for empty loops (a loop that executes until a key is pressed, for example).

Since we are on the subject of structured languages, we should address the central issue of structured programming, the GOTO statement. FORTRAN is supposed to be abysmally unstructured because it uses GOTO. Well, Pascal or C programmers don't like to talk about it very much, but their languages also use GOTO.

It would seem that PROMAL is the first truly structured language, since it does not support either the GOTO or any form of line labels required by a GOTO statement. Whereas the other

Before leaving the topic of program structure, it is important to mention that PROMAL has single-valued functions and argument passing to procedures. It insures procedure isolation by passing variables by value, instead of by location. If manipulation of variables outside a procedure is required, pointer values must be passed to the procedure, which helps make PROMAL procedures and functions truly universal. It is possible to build up libraries of procedures and use them in several programs. In fact, almost 50 library routines are included on the PROMAL system disk.

PROMAL supports data types that are very similar to the C language. There are only four types: byte, word (unsigned 16-bit precision integer), integer (signed 15-bit precision integer) and real (11 significant-digit floating point). Single indexed arrays are supported.

Where are character variables? Well, that's the one awkward thing about PROMAL. Character string variables are defined as arrays of type "byte." The actual characters in a

Table 1. PROMAL Key Words

AND	CHOOSE	FUNC	OR	TO
ARG	DATA	IF	OWN	TRUE
ASM	END	INCLUDE	PROC	UNTIL
AT	ELSE	INT	PROGRAM	WHILE
BYTE	ESCAPE	LIST	REAL	WORD
BEGIN	EXT	NEXT	REFUGE	XOR
BREAK	FALSE	NOT	REPEAT	
CON	FOR	NOTHING	RETURN	

string must be terminated by a byte of value zero (null). This isn't too bad languages have taken the lazy way out of some sticky situations by allowing GOTO, PROMAL uses other statements for the two situations where a jump is convenient. The first situation is termination of a WHILE or REPEAT loop. A complicated loop may contain expressions or tests that require termination of the loop when satisfied. PROMAL uses a BREAK keyword to terminate such a loop.

The second case is a return to a high-level routine from a low-level subroutine, bypassing any intermediate levels of code. This is often convenient if an error condition exists that requires termination of those lower levels. PROMAL has both ESCAPE and REFUGE statements that dispose of intermediate level pointers and local variables to restore context at the upper level of routines. In other languages, extensive testing of errors would have to be performed after each call at each level of the routine

PROMAL is a total system, with an operating system and an editor included on the disk with the PROMAL language.

to pass the error to the upper level properly.

until you need to manipulate large arrays of character strings, which requires doing your own housekeeping or even garbage collection. (Now you know where the term comes from!)

On the other hand, variables can be placed anywhere in memory, and range and type checking is not performed. However, although it adds to

the speed of a PROMAL program, elimination of checking can create either problems or opportunities, depending on your point of view. It is also possible to write numbers as hexadecimal values, which is very useful at times.

Zippity-Doo-Da

If you have ever played with sophisticated compilers before, you have experienced that sinking feeling as your terribly involved program using all the mega-features of the compiler grinds through endless computation to a conclusion sometime in the next century. Sometimes, getting more features has a price tag that goes beyond dollars and cents. Sometimes the compiler takes forever to compile, or the compiled program seems to operate on half-bit words.

I am glad to tell you that you won't get that feeling with PROMAL. When it comes to speed, PROMAL does very

Table 2. PROMAL Operators

Listing 1.

Sieve of Eratosthenes in PROMAL

```
PROGRAM SIEVE
INCLUDE LIBRARY
CON WORD SIZE=8190

BYTE FLAGS[SIZE]
BYTE ITER

WORD COUNT
WORD I
WORD K
WORD PRIME

BEGIN
PUT "10 ITERATIONS",CR
;
FOR ITER=1 TO 10
COUNT=0
FOR I=0 TO SIZE
FLAGS[I]=1
;
FOR I=0 TO SIZE
IF FLAGS[I]
PRIME=I+I+3
K=I+PRIME
;
WHILE K<=SIZE
FLAGS[K]=0;FALSE
K=K+PRIME
;
COUNT=COUNT+1
;
OUTPUT "#CITERATION=#I",ITER
;
;
OUTPUT "#CPRIMES=#I",COUNT
END
```

Operator	Description
ABS	Absolute value
+	Addition
-	Subtraction or negation
*	Multiplication
/	Division
%	Remainder (mod)
	Exponential
	Power
LOG	Log base 10 or base "e"
SQRT	Square root
ARCTAN	Arctangent
COS	Cosine
SIN	Sine
TAN	Tangent
<<, >>	Left shift, right shift
<, >	Relational less than, greater than
<=, >=	Relational less than or equal, greater than or equal
<>	Relational not equal
AND	Logical AND
OR	Logical OR
XOR	Logical exclusive OR
NOT	Logical complement
#	Address of variable
:<, :>	Extract low byte, high byte of word or integer type
:+	Convert to type word
:-	Convert to type integer
::	Convert to type real
@<	Indirect through pointer to type byte
@-	Indirect through pointer to type integer
@+	Indirect through pointer to type word
@.	Indirect through pointer to type real

well. Bruce Carbrey, writer of PROMAL, provided a comparison of his Sieve of Eratosthenes benchmark for program speed and other items. You'll find a summary of results in Table 3, comparing ease-of-use factors for five popular languages. A full description of Bruce's tests can be obtained from Systems Management Associates. I have performed many of the benchmarks and can say that the speed comparisons are quite valid.

Executive Decisions

So far I have discussed only the power of PROMAL the language, and have said not a word about the PROMAL operating system, otherwise known as the "executive." The executive is provided to give the PROMAL programmer the best possible support for writing and testing PROMAL programs, a subsidiary function. Since PROMAL is a superior computer language, the logic behind providing a dedicated operating system seems reasonable. Somehow, however, I still wish I could use that executive with my other languages!

We have already seen that the PROMAL language encompasses some of the best ideas from other languages, while remaining friendly, powerful and practical. The PROMAL executive is much the same. First the executive prompts for the current date, then "stamps" each program file with that date. The executive maintains an area of memory as a virtual disk drive, called the "workspace." Although there isn't enough memory on the Commodore 64 to emulate an entire disk, the speed provided by the workspace makes working on program routines extremely easy. You can keep the text version of the program in the workspace, and then compile and execute it from program memory. Therefore, both your typed program and the compiled and running program are immediately available.

Of course, the main function of the executive is to accept and perform commands entered from the keyboard. In this case, the executive is designed to use many of the keys normally ignored on the Commodore 64 keyboard, especially the CONTROL key. This is to preserve a commonality with versions of PROMAL for other, Brand X, machines that don't have

PROMAL is a very powerful, well supported computer language system. It is sophisticated, yet easy to use. Without a doubt it is one of the most significant products for the Commodore 64 appearing recently.

special function keys. However, the function keys on the Commodore 64 are still well supported by the executive. They are defined when the PROMAL system is loaded and can be redefined at any time. One of the nice things about the executive is a command buffer that remembers up to 256 bytes of keyboard entry. If you make a mistake, just press CONTROL-B and the command reappears for your correction. That isn't the only nice thing about the executive, either.

The PROMAL executive borrows an excellent idea from the OS-9 operating system. The concept is called "redirection," and it provides the facility to make a program expect input or print output with almost any device attached to your computer. You can tell the executive to run a program so that it gets its input from a disk file rather than the keyboard. You can route the output of a program to the screen, the printer, a disk file, the workspace or even to the "null" device. The null device is a handy way

to eliminate diagnostic printing when working on a graphics program, for example. Unfortunately, there is no way to tie redirection to a particular device if more than one device is used for input or output.

Commands in the PROMAL executive are always available and very powerful. At the core of this power is the ability to independently execute commands from disk files. The JOB command can be used to load in various different PROMAL programs, execute them, redirect output and input as necessary, reconfigure memory usage and perform some disk operations (including copying files with automatic prompts for disk swapping and automatic creation of a file buffer). The full range of executive commands are shown in Table 4.

Of course, one of the best things about the executive is that each PROMAL program is run just like an executive command. Programs can be thought of as extensions to the executive, and can easily be used in that manner because PROMAL produces such compact programs that several can reside in memory. In fact, the executive will first try to find any command in the built-in command set shown in the table, then look for your programs in the Commodore 64 memory, and finally search whatever disk is in the disk drive. If the program is found, the executive will automatically load and run it. You don't even need to worry about using up the Commodore 64 memory space with too many programs. If there is not enough memory available to load and run a program, the executive creates enough free memory by disposing of some of the old programs.

Some of the executive commands are quite helpful, to say the least. This is the only operating system for the Commodore 64 that I know of that

Table 3. Benchmark Test Results of Sieve of Eratosthenes

Language	Execution Program Size, Compile				Minimum
	Time	Bytes	Time	Keystrokes	
Commodore BASIC	630 sec.	255	0 sec.		9
COMAL	490	329	0		9
Micro Prod. FORTH	51	181	3.9		23
ABACUS Zoom PASCAL	55	415	108		66
SMA PROMAL	30	128	8.5		9

really has a HELP key (pre-defined as function key seven). This key (or the command HELP) will display a full screen of executive command abbreviations, as well as the special editing keys. No matter how confused you get about what commands are available, or what the function keys do, you can always call up some help.

Since the PROMAL system supports machine language programs, it seems natural that the executive would also provide some of the functions of a machine language monitor. Contents of memory can be displayed or altered. Machine language programs can be loaded and run. The ability to redirect output is a great aid when examining memory because it makes it possible, for instance, to send a memory dump to the disk for later examination or printing. While some of your favorite monitor commands may be missing, the simple commands can be written as short PROMAL programs and patched in as you need them.

But That's Not All . . .

The PROMAL editor is a compiled PROMAL program that is nearly 12,000 bytes in size. The size, believe me, is deceptive. I have seen a great many text editors, some intended just for writing programs, and this one does a lot. It is a full-screen editor with cursor controls, vertical and horizontal scrolling. The function keys are defined for the editor in a window at the bottom of the screen. Function key seven provides a ubiquitous (for PROMAL) help screen of editor commands. The editor can be put in either type-over or insert mode and has the ability to perform search and replace. It can copy, move, delete, save and recall designated blocks. It supports indentation levels so that tabs are not needed.

While the PROMAL editor is not exactly a word processor, it is a very excellent program editor. Many language packages do not provide such a good editor. This one does a very good job of helping write PROMAL programs.

About PROMAL Support

Probably the best clue to support for a software package is the manual that comes with the package. I say "clue" instead of "gauge" because

Table 4. PROMAL Executive Commands

Command	Function
COLOR	Change the current character or screen color
COPY	Copy a file
CS	Clear the screen
DATE	Change the current date
DELETE	Delete a PROMAL file
DUMP	Display memory in Hexadecimal and ASCII characters
EDIT	Enter the full screen PROMAL Editor
FILES	Display the names and sizes of all or selected files.
FILL	Fill a region of memory with a constant
FKEY	Redefine a function key
GET	Load a PROMAL or machine language program into memory
GO	Execute a machine language program
HELP	Display a "help" menu for executive commands and keys
JOB	Execute a list of executive commands stored in a file
MAP	Display the current memory allocation and loaded program names
NOREAL	Discard support for REAL data (increases free memory)
QUIT	Exit to BASIC
RENAME	Change the name of a PROMAL file
SET	Set memory locations to specified values or characters
SIZE	Display the size of a compiled PROMAL program
TYPE	Display a file of text on the screen, printer, etc.
UNLOAD	Remove a PROMAL program from memory
WS	Clear or alter the size of the Workspace

Systems Management Associates is doing an even better job on support than they did in producing the PROMAL manuals. Purchasers of the PROMAL system get regular notices of program updates, which are easily patched into the system. SMA is actively listening to PROMAL users, and is adding features to the language to extend its utility. For example, support for transcendental functions was added in December of 1984. SMA plans to publish a newsletter in the second quarter of 1985 and user groups will be recognized.

But you find all of that out when you read the manuals. There are three manuals in a very nice binder. The three parts are "Meet PROMAL!" the "PROMAL User's Guide," and the "PROMAL Language." These provide a solid foundation for exploring the PROMAL system. They detail the operation of the system and how memory is used. Instructions are provided for patching machine language into PROMAL programs. There are extensive examples that coordinate with

sample programs on the PROMAL disk. Syntax diagrams of the language are provided, along with a short tutorial on how to read them! It almost goes without saying that the manuals have a good table of contents and index.

In short, I think that PROMAL is a very powerful, well supported computer language system. It is sophisticated, yet easy to use. Without a doubt it is one of the most significant products for the Commodore 64 appearing recently. If you cannot try PROMAL at a friend's house or at the dealer, it is possible to purchase a PROMAL demo disk from Systems Management Associates (3700 Computer Drive, Raleigh, NC 27609) for \$12.50 (including postage and handling). Considering that the end-user system (which cannot produce stand-alone PROMAL programs) is \$49.95, with full credit toward the developer's system (which can), I would recommend the end-user system over the demo disk if you are really interested.

Cardco MT/1 Monitor Tuner

Manufacturer: Cardco, Inc.
300 S. Topeka
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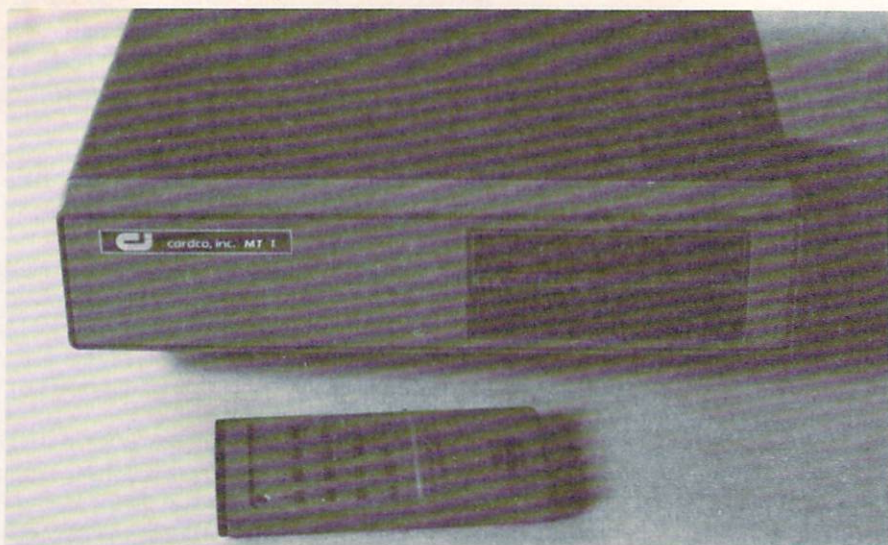
Just about anyone who's ever used a color monitor will tell you how superior the video image is over a conventional television picture. Too bad you can't get that same sharp, crisp image on the screen for watching your favorite television shows, right? Wrong. You *can* get a superb television picture and make your monitor do *double duty* as well, with the Cardco MT/1 Monitor Tuner.

This unique device allows you to watch television programs on your computer monitor when you're not busy computing. Not only does it convert your monitor into a television, but the picture clarity and resolution is absolutely *superb*—as good or better than any color television image I've ever seen.

The MT/1 comes complete with everything you need to convert your 1702 or other monitor into a first-class television with wireless remote control. If that's not enough, check this out: the unit is *cable ready* and it can output multiplex *stereo* sound as well. Of course, to take full advantage of this stereo capability, two things are needed: the TV program must be broadcast or cabled in stereo and a stereophonic amplifier is needed.

A good example of such a TV program is *MTV*, if your cable network carries it. By routing the stereo output from the tuner into your home stereo system, you can enjoy all your favorite music videos in glorious stereo sound with an excellent picture to match. To say I was impressed with the capabilities and performance of the MT/1 is an understatement.

The MT/1 is supplied with a nifty little wireless remote control module. This module is powered by two AAA cells and they should last well over a year with normal usage. In addition to changing channels with the unit, you can also "glide" up or down the channels to quick-scan what's on the tube. Controls are also provided for con-



You can get a superb television picture and make your monitor do double duty as well, with the Cardco MT/1 Monitor Tuner.

trolling the volume and turning the MT/1 on and off. The back of the remote control module has a conversion chart on it so you can punch-up your favorite cable channel without having to go through the usual cable box. This remote control module is indeed a lazy person's delight—it would seem that Cardco left no stone unturned when it came to useful features for the MT/1.

The tuner itself is color-coordinated to match the Commodore 1702 monitor perfectly and the compact unit can be placed atop the monitor. Red LED indicators let you know what channel you're tuned to and their large size affords high visibility from virtually anywhere in the room. Infra-red signals from the remote unit handle the channel-changing chores in grand style and they're not affected by room light (or lack of it).

Hooking up the MT/1 is a simple matter: one jack on back of the unit accepts input from either an antenna or cable signal, a video-out jack sends

the picture to the monitor, and an audio-out jacks handle the sound. If you're not going the stereo sound route, just plug one of the audio-outs into the monitor's audio jack. If you do wish to have enhanced sound, the audio-outs go to the tape or aux-in jacks on the stereo. That's it for the MT/1's cable connections.

There's one feature about the MT/1 that is really the icing on the cake, which is why I saved it for last. On the back of the tuner module there's an AC jack into which you plug your monitor's power cord. What's so great about that, you ask? Well, when you cut the power to the tuner, the monitor's power is cancelled as well—the real beauty is that it's handled through the remote-control module, completely negating the need to get up and turn the monitor off... pretty slick, eh?

If you're thinking of buying a second TV, why not consider getting an MT/1 tuner instead? It's a great way to use your monitor for regular television viewing when you're not computing with it. That way you can have the best of both worlds—superb imagery for your computing and an outstanding television picture as well. Oh, yes—let's not forget that wonderful wireless remote control and stereo sound capability, too. Congratulations to Cardco on a superb piece of hardware that performs behind all expectations. I have no reservations about recommending the MT/1 and only the highest praise for it. Suggested retail price is \$199.

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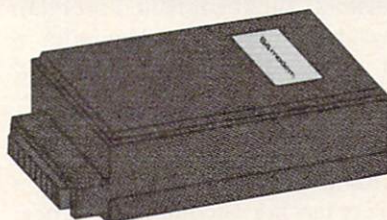
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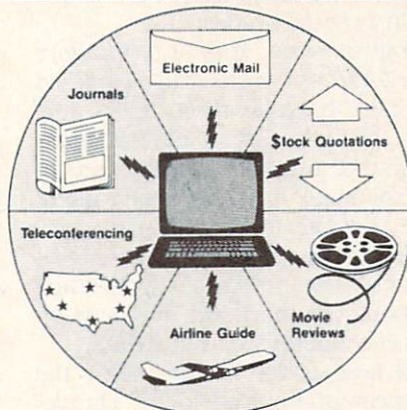
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Programming Your Commodore 64 in BASIC

Author: Mario J. Eisenbacher

Publisher: Spectrum
Prentice-Hall
Englewood Cliffs, NJ
07632

Programming Your Commodore 64 in BASIC is fundamentally a tutorial which aids the student-reader in becoming a BASIC programmer via a series of highly structured instructional descriptions and subsequent exercises. Each progressive chapter or "level" is harder than the preceding one and builds upon the more elementary concepts.

Level 1 deals with getting acquainted with the 64 keyboard layout, "getting started" procedures, PRINT statement tips and tricks, using colors, the TAB/SPC functions, the INPUT function and computer-generated prompts. Level 2 teaches the various mathematical operators/symbols, operational priorities, assigning numeric variables, simple loops (FOR/NEXT), conditional statements, and flowcharts.

Level 3 shows readers how they can use the 64 to generate random numbers, the INT function, such mathematical functions as ABS, SGN, SQR, time control using TI and TIS, the GET statement, setting up DATA statements, reading/restoring that data and creating data arrays (DIM statement). Level 4, a very short chapter, deals with computer terminology, an introduction to binary math and 64 peripherals. Level 5 teaches readers alphanumeric strings, string manipulation and Boolean logic (AND, OR).

Level 6 introduces the GOSUB/RETURN branch statements, PEEK and POKE, memory maps, simple graphic displays, how to control bits using logic, advanced display modes, including sprites and multi-color bit mapping, sound production using the SID chip and combining sound and sprites. Level 7 is the "applications"

chapter where different computer programming examples are described, listed and explained.

Besides the seven programming levels, this book also contains lesson reviews, practice exercises, "interest stimulators" (undocumented program listings) and appendices. The index is quite good for fast reference and retrieval.

There were many things which I like about this book. I feel that the author has the potential of becoming a premiere teacher of computer science, specifically on the Commodore 64 system, through his writings. Although pedantic at times, he demonstrates throughout this book his command of the subject and love for the 64 in general.

The author's step-by-step programming directions are clear and easy to follow. I especially like the editorial treatment of important programming techniques, as graphically highlighted within a special border.

Programming Your Commodore 64 in BASIC is easy to read—I studied the entire book in three hours—because the author treats his readers as friends. We are supplied the secrets of his experience in an informal tone of voice. I've been professionally programming for seven years now and I learned a few new tricks by reading this book. In short, the author is always encouraging to his readers.

The best section in this book is the treatment of Boolean logic. The author's explanation of AND and OR, as well as bit manipulation using these two logical expressions, is among the best I've seen. Likewise, summary reviews and practice exercises are well

done. (I firmly believe that well designed practice exercises—and documented answers—are very important to a self-instructing manual of this kind.)

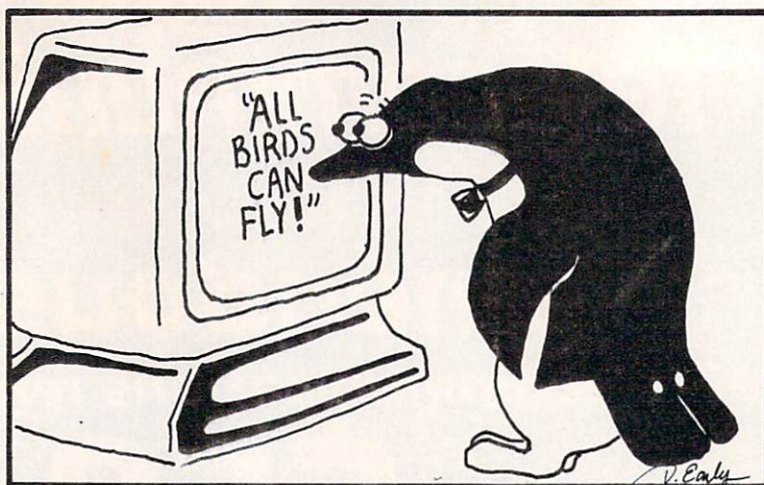
In fact, when the author is good, he is very, very good. His explanation of nested loops, for an example, is terrific. I also liked his "User Formulas" included in the book's appendix.

One thing that bothered me about the book was its lack of clarification and misuse of generalization. The author frequently presents his comments as absolute truth—a programming dogma—when in reality, the comment should have been qualified with specific conditions of validity. For example, if I wrote that "all birds fly," I would be in error. There are some species of birds (penguins) which do not fly, newborn birds have to learn to fly, birds with broken wings can't fly and dead birds are permanently grounded.

In this way, the author often makes statements which might be accepted as 100% fact by a novice programmer.

Last but not least, why do some publishing companies fail to use the computer symbol for the number zero (0)? Don't they realize that their typeset zeros often look like the letter "O"? Another way to confuse readers.

I feel that this book is for those novice users who have had the opportunity to experience their Commodore 64 for a few weeks and provides the perfect bridge between beginner and intermediate computer knowledge. *Programming Your Commodore 64 in BASIC* is a step in the right direction for all concerned.



Learning Commodore 64 LOGO Together

Author: Kenneth Goldberg
Publisher: Microsoft Press
10700 Northrup Way
Bellevue, WA 98009

When I first purchased my Commodore 64, I noticed on the store shelves the title LOGO. At the time, the only concept I had of LOGO was that it had something to do with a stylized turtle moving around on a computer screen. Since I was a neophyte at computing, I naturally chose BASIC, the built-in language of the 64. But I would occasionally come across LOGO in my reading and wonder what it was all about. Eventually I broke down and bought the Commodore LOGO cartridge.

The LOGO package came with a well written manual. Somehow, however, I felt the manual was not oriented toward ground-floor beginners. I combed the bookstores looking for a book that would help me digest what LOGO was really all about. Need I say the search was a long one.

Finally, I found Kenneth Goldberg's book, *Learning Commodore 64 LOGO Together*. Goldberg's book was a LOGO delight. Here was a book that truly served the needs of the beginner. His book is well structured, well written and, most important, well organized. He takes the beginner step by step through LOGO, from the fundamentals to the complex, and does a superb job of it.

The book begins by giving a short history of why LOGO was developed, what its uses are, and what need it satisfies. A "How to Use This Book" is provided, along with a list of the hardware and software that will be required. He doesn't leave the user in the dark.

The first chapter discusses the language itself. Here the author explains that LOGO is an excellent learning tool, which reinforces the processes

I don't hesitate to predict that this book will become a LOGO classic. It can easily be adapted to a classroom environment and will most assuredly find its niche with addicted LOGO users.

of learning by building complex structures out of basic ones. The concept of modular programming is also addressed. Modular programming can be used as an invaluable introduction to higher level languages such as Pascal.

The second chapter gives a full description of how to get LOGO running using the computer, disk and software. No loose ends here. Chapters 3 and 4 deal specifically with the basic LOGO commands required to deal with programming in LOGO such as DRAW, NODRAW, PENUP and PENDOWN.

The real programming power of LOGO begins with Chapter 6. Here the author provides ample description of what procedures are and how they are constructed. He explains how to use, write, modify, save, load and print procedures. Chapter 7 goes into more detailed discussion of what procedures really are and what they can do. It should not escape the observant reader of these chapters that LOGO's ability to create procedures can itself be used to construct a new language.

Chapters 8 and 9 provide more extensive examples and explanations. Variables and their use in procedures are explained; so is parameter passing (that is, passing one value in a variable to another variable). Chapter 10 intro-


duces recursion, which is where LOGO really shines. Recursion is the ability of something to call back on itself, much like pulling oneself up by one's shoestrings. This is a strange concept and certainly hard to grasp at first. The author, however, cuts the fluff and gets to examples which clearly explain how recursive procedures are written and used.

Sprites are dealt with in Chapters 11 and 12. Everything needed to create and use sprites in LOGO is covered. Numerous examples are provided as to how to use, create, save and use a sprite.

Chapters 13 and 14 deal with the mathematical side of LOGO and explain how the mathematical operations of LOGO are used and implemented in program mode. List processing, which is a LOGO ability to work with words and sentences, is covered in Chapters 15 and 16. The author differentiates clearly between the ability to work with words and the ability to perform list processing. In essence, a list can be a word or group of words which can make up a sentence. LOGO can act on these sentences. Amazing things can be achieved with this capability and it is easily a separate art form in itself.

To cap off this exceptional book, Goldberg covers the 64's unique music capability. LOGO 64 has built-in music commands and these are explained and supported with ample samples.

All in all, *Learning Commodore 64 LOGO Together* is truly a superb learning product. I don't hesitate to predict that this book will become a LOGO classic. It can easily be adapted to a classroom environment and will most assuredly find its niche with addicted LOGO users. The author took a conscientious attitude in assembling his material and the end result is a smooth-flowing narrative with very few gaps. This is the way introductory books on specific fields of knowledge should be written.

If you are struggling with LOGO and desire a good introductory book on the subject, are an educator searching for an exceptional text, or even an intermediate user who wants to sharpen his skills, then Goldberg's book is definitely for you. 

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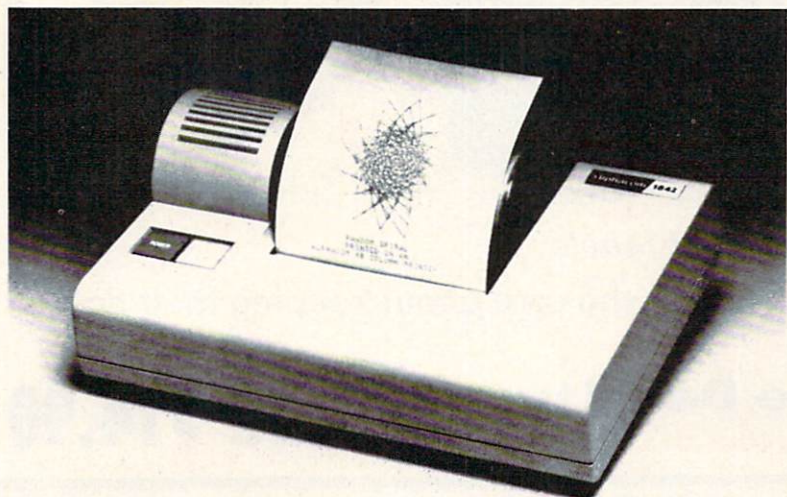
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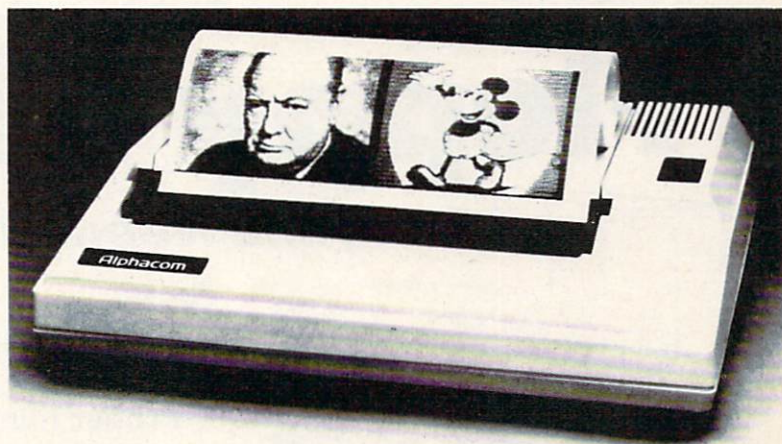
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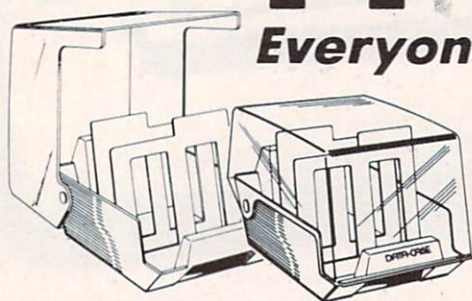
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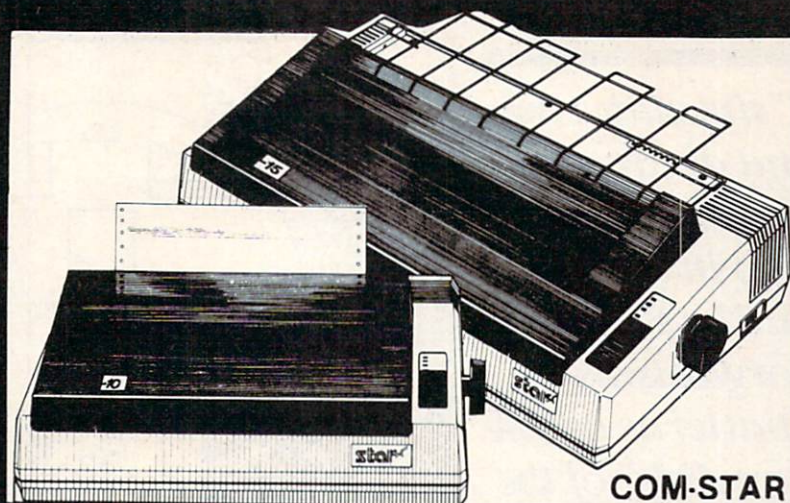
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The Game of Life

for the VIC 20 and Commodore 64

Whenever computers and mathematics meet art, there is sure to be mutual fascination. One such meeting of the minds is contained in the game of "Life." The game was invented in the early 1970's by John Horton Conway, a mathematician at the University of Cambridge. It was further explored by Martin Gardner in *Scientific American's* Mathematical Games column in October 1970 and February 1971.

"Life" simulates the rise and decline of generations of organisms in a population. The simulated organisms form patterns on the "culture disk" of the computer screen. One can sit and watch them develop for hours in an intriguing evolution.

Conway began playing the game using a large checkerboard for his mini-universe. Each square of the board was either occupied by an organism (a checker) or empty. Each square has eight neighboring squares (those next to it and those diagonal to it). After you set up any desired starting pattern, the configuration of the board in the next generation is determined by three simple rules:

1. Any checker surrounded by two or three neighboring checkers survives.

2. Four or more neighbors dooms a checker because of overpopulation (it is removed). On the other hand, having no neighbors or only one leads to death from isolation.

3. An empty cell with exactly three neighbors has a checker born into it.

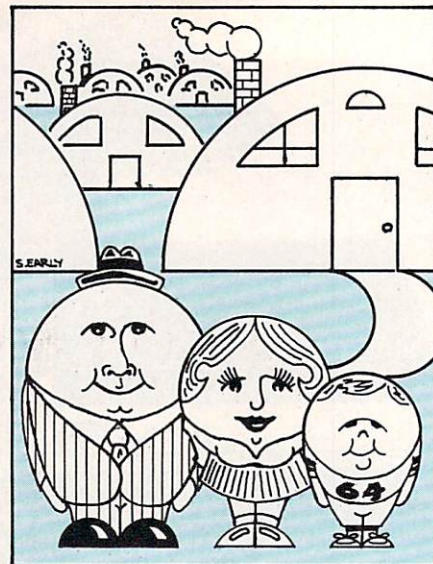
A single organism dies on the next generation from isolation. Similarly, any pair of organisms will die in one generation.

Five examples of the results starting with groups of three are illustrated in Figure 1. These groups of three reveal all the possible fates of patterns on a finite board. Organisms can die as in examples 1, 2 and 3, become stable as

"Life" simulates the rise and decline of generations of organisms in a population. The simulated organisms form patterns on the "culture disk" of the computer screen.

in 4, or oscillate as in 5. Some patterns oscillate with periods greater than two. For example, the pattern in Figure 2 takes eight generations to return to the original pattern and repeat. Known as the "figure eight," it was discovered by Simon Norton.

The rules for the game are so simple that one cannot imagine the complexity and sensitivity of the patterns the organisms form. During one generation, the colony can be perceived as ready to die out completely, and then, several generations later, be a thriving, growing community.



ing, growing community.

Conway developed complicated procedures for playing the game on a checkerboard. However, it is fairly straightforward to write a computer program to keep track of the generations and display the board. Although Conway always assumed an endless board, the programs for the Commodore 64 and VIC 20 discussed here use a finite board the size of the computer screen.

Program Description

There are two versions of the program for each machine. The first version starts with a random pattern. This can result in marvelous patterns after several generations. The second version allows the user to input the starting pattern. The player uses the cursor keys to move around on the screen, the asterisk key to put up a living cell, the space bar to put up an empty cell, or RETURN to start the generations developing. The only difference between the two versions is the addition of lines 30 through 160 and the removal of line 200 in the user-input version.

Line 10 sets up pointers to a work area (W), which is used to store the number of neighbors for each cell and color RAM (C). In addition, line 10 colors the background and border black. Line 20 reads a machine language routine, which is described below and puts it in memory.

In the user-input version, line 30 fills the screen with black circles, sets the cell color (CC) to white and initial-

Figure 1. Generating Patterns from Three Organisms

Example NO.	Generation		
	0	1	2
1			DIES
2			DIES
3			DIES
4			STABLE
5			OSCILLATES

izes where the cursor is (K) and what color is under the cursor (S). Line 40 reads the keyboard and flashes the cursor. Lines 50 through 120 act on the input by handling cursor keys and placing or removing organisms. The subroutine in lines 150 and 160 moves the cursor.

In the random-pattern version, line 200 fills the screen with circles equally likely to be black or white and starts the cell color (CC) at white.

Line 210 clears the work area and increments the cell color. Line 220 calls the machine language subroutine. This routine looks at each cell on the screen, decides how many neighbors it has and records that number in the work area. The same could be done with a couple of BASIC statements, but the program would run extremely slowly.

Lines 270 through 310 use the information stored in the work area to put up the next screen. In line 270 the location of the current cell on the screen is calculated. Then, in 280 the number of neighbors that cell has is used to decide whether the cell lives or dies in the next generation. Line 290 is for birth, line 300 is for death

Figure 2. An Oscillator with Period 8

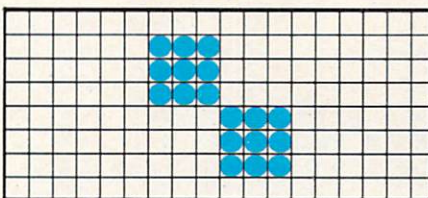
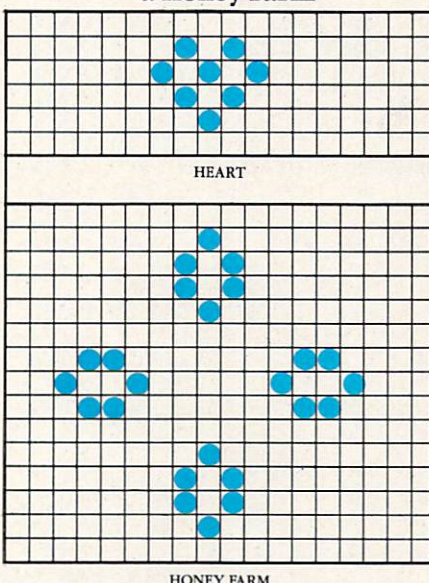


Figure 3. Evolution of a Heart to a Honey Farm



and going directly to 310 preserves the current situation. If you wish to experiment with slightly different rules, line 280 could be changed to go different places depending on the number of neighbors found. Finally, lines 1000 through 1090 contain the machine language subroutine.

Commodore 64 users will find that the time required between generations is greater for them than for VIC 20 users. This is because the number of cells on the screen is nearly doubled on the 64. However, 64 users will be able to experiment with larger patterns than on the VIC, so there are also advantages.

Figure 3 shows a pattern I call the "heart," and its result after 17 generations, the "honey farm." The honey farm consists of four stable figures known as beehives. The patterns of each generation can be beautiful and surprising. Using a similar program, I once generated many generations of a large "X." The 27th generation became the basis for a beautiful woven tapestry (The 27th Generation of "X," by Katherine Merten). I wish you many hours of creative enjoyment of "Life."

64 Input

```
10 W=51968:C=55296:POKE 53280,0
:POKE 53281,0'EEYF
20 FOR K=49152 TO 49249:READ M
:POKE K,M:NEXT'GSUF
30 FOR K=0 TO 999:POKE 1024+K,81
:POKE C+K,0:NEXT:CC=1:K=0:S=0'LFJM
40 GET A$:IF A$="" THEN A=PEEK(C+K)
:POKE C+K,NOT(A AND 1)AND(A OR
1)'NWFN
50 IF A$=CHR$(42) THEN S=1:D=1
:GOSUB 150'HPLI
60 IF A$=CHR$(13) THEN POKE C+K,S
:GOTO 210'HOEJ
70 IF A$=CHR$(29) THEN D=1
:GOSUB 150'GMEJ
80 IF A$=CHR$(157) THEN D=-1
:GOSUB 150'HNTL
90 IF A$=CHR$(17) THEN D=40
:GOSUB 150'GNCL
100 IF A$=CHR$(145) THEN D=-40
:GOSUB 150'HORC
110 IF A$=CHR$(32) THEN S=0:D=1
:GOSUB 150'HPJD
120 GOTO 40'BCLW
150 POKE C+K,S:K=K+D:IF K>999 OR K<0
THEN K=K-D'LSEL
160 S=PEEK(C+K):RETURN'EGYF
210 FOR K=0 TO 1133:POKE W+K,0:NEXT
```

```
:CC=CC+1:IF CC>15 THEN CC=1'MBWK
220 SYS 49152'BfMY
270 FOR I=1 TO 25:FOR J=1 TO 40
:M=C+(I-1)*40+J-1'MUKP
280 ON PEEK(W+I*42+J)+1 GOTO 300,300,
310,290,300,300,300,300,300'HSKQ
290 POKE M,CC:GOTO 310'CILH
300 POKE M,0'BDNX
310 NEXT J,I:GOTO 210'CHAA
1000 DATA 169,39,133,253,169,0,133,
254,169,216'BLJA
1010 DATA 133,255,169,0,141,36,192,
169,203,141'BLTB
1020 DATA 37,192,160,0,177,254,41,15,
240,11'BIQB
1030 DATA 160,7,190,90,192,254,17,17,
136,16'BIGC
1040 DATA 247,238,36,192,208,3,238,37,
192,198'BKUE
1050 DATA 253,16,18,169,39,133,253,24,
173,36'BJGF
1060 DATA 192,105,2,141,36,192,144,3,
238,37'BIYF
1070 DATA 192,230,254,208,2,230,255,
165,254,201'BMLH
1080 DATA 232,208,195,165,255,201,219,
208,189,96'BNPI
1090 DATA 0,1,2,42,44,84,85,86'BUTG
```

Continued next page

PROGRAMMERS' TIPS

VIC Input

```

10 W=7080:C=38400:POKE 36879,8
20 FOR K=6982 TO 7079:READ M:POKE K,M
   :NEXT
30 FOR K=0 TO 505:POKE 7680+K,81
   :POKE C+K,0:NEXT:CC=1:K=0:S=0
40 GET AS:IF AS="" THEN A=PEEK(C+K)
   :POKE C+K,NOT(A AND 1)AND(A OR 1)
50 IF AS=CHR$(42) THEN S=1:D=1
   :GOSUB 150
60 IF AS=CHR$(13) THEN POKE C+K,S
   :GOTO 210
70 IF AS=CHR$(29) THEN D=1:GOSUB 150
80 IF AS=CHR$(157) THEN D=-1:GOSUB 150
90 IF AS=CHR$(17) THEN D=22:GOSUB 150
100 IF AS=CHR$(145) THEN D=-22
   :GOSUB 150
110 IF AS=CHR$(32) THEN S=0:D=1
   :GOSUB 150
120 GOTO 40
150 POKE C+K,S:K=K+D:IF K>505 OR K<0
   THEN K=K-D
160 S=PEEK(C+K):RETURN
210 FOR K=0 TO 599:POKE W+K,0:NEXT
   :CC=CC+1:IF CC>7 THEN CC=1
220 SYS 6982
270 FOR I=1 TO 23:FOR J=1 TO 22
   :M=C+(I-1)*22+J-1
280 ON PEEK(W+I*24+J)+1 GOTO 300,300,
   310,290,300,300,300,300,300
290 POKE M,CC:GOTO 310
300 POKE M,0
310 NEXT J,I:GOTO 210
1000 DATA 169,21,133,253,169,0,133,
   254,169,150
1010 DATA 133,255,169,168,141,106,27,
   169,27,141
1020 DATA 107,27,160,0,177,254,41,7,
   240,11
1030 DATA 160,7,190,160,27,254,17,17,
   136,16
1040 DATA 247,238,106,27,208,3,238,
   107,27,198
1050 DATA 253,16,18,169,21,133,253,24,
   173,106
1060 DATA 27,105,2,141,106,27,144,3,
   238,107
1070 DATA 27,230,254,208,2,230,255,
   165,254,201
1080 DATA 250,208,195,165,255,201,151,
   208,189,96
1090 DATA 0,1,2,24,26,48,49,50

```

64 Random

```

10 W=51968:C=55296:POKE 53280,0
   :POKE 53281,0'EYF
20 FOR K=49152 TO 49249:READ M
   :POKE K,M:NEXT'GSUF
200 FOR K=0 TO 999:POKE 1024+K,81
   :POKE C+K,INT(RND(1)*2):NEXT
   :CC=1'MELJ
210 FOR K=0 TO 1133:POKE W+K,0:NEXT
   :CC=CC+1:IF CC>15 THEN CC=1'MBWK

```

```

220 SYS 49152'BFMY
270 FOR I=1 TO 25:FOR J=1 TO 40
   :M=C+(I-1)*40+J-1'MUKP
280 ON PEEK(W+I*42+J)+1 GOTO 300,300,
   310,290,300,300,300,300,300'HSKQ
290 POKE M,CC:GOTO 310'CILH
300 POKE M,0'BDNX
310 NEXT J,I:GOTO 210'CHAA
1000 DATA 169,39,133,253,169,0,133,
   254,169,216'BLJA
1010 DATA 133,255,169,0,141,36,192,
   169,203,141'BLTB
1020 DATA 37,192,160,0,177,254,41,15,
   240,11'BIQB
1030 DATA 160,7,190,90,192,254,17,17,
   136,16'BIGC
1040 DATA 247,238,36,192,208,3,238,37,
   192,198'BKUE
1050 DATA 253,16,18,169,39,133,253,24,
   173,36'BJGF
1060 DATA 192,105,2,141,36,192,144,3,
   238,37'BIYF
1070 DATA 192,230,254,208,2,230,255,
   165,254,201'BMLH
1080 DATA 232,208,195,165,255,201,219,
   208,189,96'BNPI
1090 DATA 0,1,2,42,44,84,85,86'BUTG

```

VIC Random

```

10 W=7080:C=38400:POKE 36879,8
20 FOR K=6982 TO 7079:READ M:POKE K,M
   :NEXT
200 FOR K=0 TO 505:POKE 7680+K,81
   :POKE C+K,INT(RND(1)*2):NEXT:CC=1
210 FOR K=0 TO 599:POKE W+K,0:NEXT
   :CC=CC+1:IF CC>7 THEN CC=1
220 SYS 6982
270 FOR I=1 TO 23:FOR J=1 TO 22
   :M=C+(I-1)*22+J-1
280 ON PEEK(W+I*24+J)+1 GOTO 300,300,
   310,290,300,300,300,300,300
290 POKE M,CC:GOTO 310
300 POKE M,0
310 NEXT J,I:GOTO 210
1000 DATA 169,21,133,253,169,0,133,
   254,169,150
1010 DATA 133,255,169,168,141,106,27,
   169,27,141
1020 DATA 107,27,160,0,177,254,41,7,
   240,11
1030 DATA 160,7,190,160,27,254,17,17,
   136,16
1040 DATA 247,238,106,27,208,3,238,
   107,27,198
1050 DATA 253,16,18,169,21,133,253,24,
   173,106
1060 DATA 27,105,2,141,106,27,144,3,
   238,107
1070 DATA 27,230,254,208,2,230,255,
   165,254,201
1080 DATA 250,208,195,165,255,201,151,
   208,189,96
1090 DATA 0,1,2,24,26,48,49,50

```

(END)

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The \$10 Keyboard Kneeboard

Relieve the clutter at your computer workspace with a simple sliding shelf.

Back in a simpler age, when the typewriter and the index file abounded, a level desktop was about all one needed to accommodate the paraphernalia of the day's activities.

Suddenly, with the advent of the computer and its attendant keyboard, drive, monitor, storage library, printer, interface, joystick, mouse, drawing tablet and overlays, the once-neat desktop has come to resemble the aftermath of the Battle of Austerlitz.

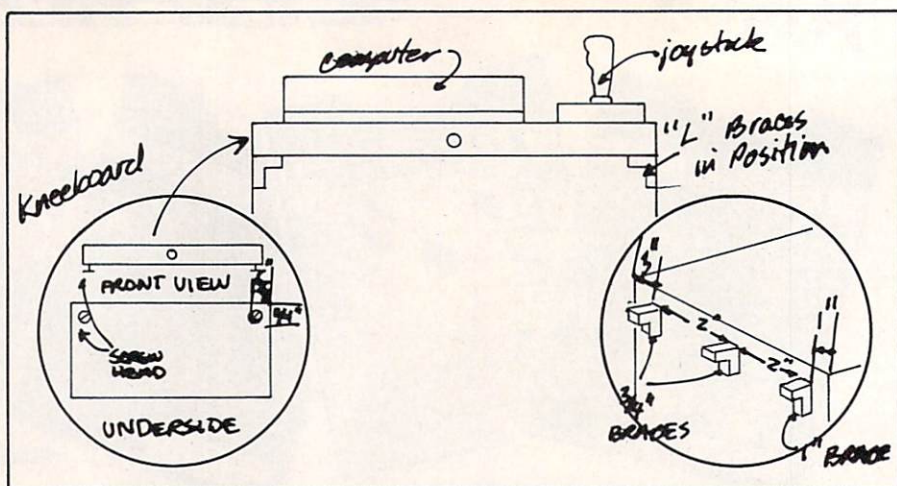
Many new computerists solve their shrinking space problem simply by buying a new piece of furniture designed to accept all the components. However, there are still a few undaunted souls loyal to their comfortable old workspaces, and others who believe that the way to lick a problem is not simply to throw money at it.

For these intrepid individuals, we herewith submit the \$10 Keyboard Kneeboard, a simple, inexpensive way to help alleviate some of the workspace clutter problem.

The Kneeboard is a sliding shelf which installs under your desktop, in the place normally occupied by the center drawer of the office desk.

As simple as it is to install, the \$10 Keyboard Kneeboard actually will perform at least five important functions:

1. It will allow you to tilt your keyboard, making it easier to enter data, especially the numeric kind.
2. It will lower your typing surface about one inch, which relieves strain for a lot of people who are uncomfortable working at a higher keyboard.
3. It provides a comfortable waist-high surface on which to rest



your joystick, drawing tablet, mouse or other smallish input device, thus eliminating the need to shunt the keyboard to another part of a crowded desk when you want to work with a different controller directly in front of you.

4. It permits farsighted people to back off a few inches from the monitor when using the keyboard, joystick or other controller.
5. Most important, it virtually doubles the work area directly in front of you when you're seated at the computer.

Equally convenient, the Kneeboard unobtrusively slides away under your desktop, just like a center drawer, when not in use. So it provides additional space only when you need it. When you don't need it, it's neatly nested out of the way.

The Kneeboard is primarily designed for wooden desks or worktables that have a kneehole—that is, supports on either side with a cavity for the knees. To the inside of these side supports, we will affix braces to hold up our shelf. For tables without kneehole-style supports, adaptations can be made by installing the braces on the underside of the desktop. In this case, a different type of bracket will be required, but the theory and, hopefully, the result, will be the same.

All right, you cluttered-up computerists, grab your tape measures and let's go to work.

First, carefully measure the kneehole's width, left to right. Our shelf will fit precisely into the space between the vertical uprights. The

depth—or area the shelf will slide out—can vary depending upon the depth of your desktop. Keep in mind, however, that the deeper you make it, the more stress your braces will have to handle. If it's too deep, the shelf will tilt and the braces will loosen. Picture a center drawer—the further out you pull it, the less stability it has.

Maximum depth should be 18 inches; a perfect depth is 14 inches. (The Commodore 64 keyboard itself is only eight inches, front to back.)

At your lumberyard, pick up a piece of $\frac{3}{4}$ -inch common pine, cut to the measurements determined (width of kneehole \times depth of shelf). At your hardware store, ask for four one-inch and two $\frac{3}{4}$ -inch corner braces. (These are "L" shaped metal objects with screw holes in each leg.)

When you get your shelf home, treat it immediately so it won't warp. Sand it for smoothness and stain, paint or varnish it. Polyurethane is a good finish since it protects against nicks and scratches. Your shelf is going to see a lot of action sliding in and out under your desk.

Installation is simple, but should be done with care and accuracy. If you don't leave enough room for the shelf to glide easily, it will bind. Too much play will cause wobble. And we don't want binding or wobbling shelves beneath our keyboards, do we?

The corner braces are installed horizontal plane up, vertical legs pointing down. The vertical sides are screwed into the supports on each side of the kneehole. The Kneeboard will then ride on the horizontal plane like a baker's tray sliding into an oven.

Continued on page 114

Home University

On Matrix Algebra and Computer Arrays, Part 2

In this article we will deal with the solution of systems of linear equations. We shall begin with a problem which demonstrates a simple case of three coupled linear equations.

Suppose that a computer manufacturer can ship only 3000 units every day, including computers, monitors and disk drives. The company's policy is to provide dealers with a number of computers which is ten times the number of monitors. The cost of a computer is \$150, a monitor is sold for \$120 and the disk drive costs \$220. The company aims at a daily gross income of \$500,000. How many units of each kind should the company produce every day?

The first step is a mathematical formulation of the problem. Let us denote the number of computers to be manufactured daily as x_1 , the number of monitors as x_2 and that of drives x_3 . The first equation states that the total number $x_1 + x_2 + x_3 = 3000$ units/day. The second equation expresses the company's policy, i.e., the number of computers is ten times the number of monitors, or $x_1 = 10x_2$ units/day. Finally, the gross daily income is $150x_1 + 120x_2 + 220x_3 = \$500,000$. We now write the three equations in the following form:

$$\begin{aligned} 150x_1 + 120x_2 + 220x_3 &= 500000 \\ x_1 - 10x_2 - 0x_3 &= 0 \\ x_1 + x_2 + x_3 &= 3000 \end{aligned} \quad (1)$$

For a small size problem, such as the system of equations (1), the solution process is quite simple. For example, the second equation allows us to express x_1 as

$$x_1 = 10x_2 \quad (2)$$

We now substitute for x_1 in the third equation to obtain

$$10x_2 + x_2 + x_3 = 3000 \quad (3)$$

which is equivalent to

$$11x_2 + x_3 = 3000 \quad (4a)$$

$$x_2 = (3000 - x_3)/11 \quad (4b)$$

Since x_2 is expressed in terms of x_3 in equation (4b), and x_1 is given in

terms of x_2 in equation (2), then x_1 can also be expressed in terms of x_3 alone

$$x_1 = 10(3000 - x_3)/11$$

Now we use the expressions for x_2 in equation (4b) and x_1 in equation (5) in the first equation (1):

$$\begin{aligned} 150 \times 10[(3000 - x_3)/11] + \\ 120(3000 - x_3)/11 + \\ 220x_3 = 500000 \end{aligned} \quad (6)$$

which can be solved for x_3

$$x_3 = 800 \text{ units/day}$$

Substituting this value in equation (4b) we get:

$$x_2 = 200 \text{ units/day}$$

And finally, from equation (2):

$$x_1 = 2000 \text{ units/day}$$

Matrix Formulation

In many cases, however, we have all system coefficients nonzero, unlike the system (1) which has two zeros in the second equation. Also, the system of equations may be large, making the manual solution a tedious, or even impossible effort. Thus, we need to use a computer to solve the problem.

For example, we can express a general system of equations as shown in (7) below.

Applied to equation (1) this would mean $a_{11} = 150$, $a_{12} = 120$, and $a_{13} = 220$, $a_{21} = 1$, $a_{22} = -10$, $a_{23} = 0$, etc. Using the rules of matrix multiplication discussed in Part 1 (January/February), we can express the system (7) in the form

$$Ax = b \quad (8)$$

where A is the $(n \times m)$ matrix with coefficients a_{ij} , x is a $(n \times 1)$ vector of the unknowns x_i , and b is the $(n \times 1)$ vector of constants b_i (the elements on the right hand side of equation (7)).

$$a_{11}x_1 + a_{12}x_2 + \dots + a_{1j}x_j + \dots + a_{1n}x_n = b_1$$

$$a_{21}x_1 + a_{22}x_2 + \dots + a_{2j}x_j + \dots + a_{2n}x_n = b_2$$

$$\dots$$

$$\dots$$

$$a_{i1}x_1 + a_{i2}x_2 + \dots + a_{ij}x_j + \dots + a_{in}x_n = b_i \quad (7)$$

$$\dots$$

$$\dots$$

$$a_{n1}x_1 + a_{n2}x_2 + \dots + a_{nj}x_j + \dots + a_{nn}x_n = b_n$$

$$\dots$$

$$1x_1 + a_{12}/a_{11}x_2 + \dots + a_{1n}/a_{11}x_n = b_1/a_{11} \quad (10)$$

$$\dots$$

$$a_{21}a_{11}x_1 + a_{21}(a_{12}/a_{11})x_2 + \dots + a_{21}(a_{1n}/a_{11})x_n = a_{21}(b_1/a_{11}) \quad (12)$$

$$\dots$$

$$a_{21}x_1 + a_{22}x_2 + \dots + a_{2n}x_n = b_2$$

$$-a_{21}x_1 + a_{21}(a_{12}/a_{11})x_2 + \dots + a_{21}(a_{1n}/a_{11})x_n = a_{21}(b_1/a_{11}) \quad (13a)$$

$$[a_{22} - a_{21}(a_{12}/a_{11})]x_2 + \dots + [a_{2n} - a_{21}(a_{1n}/a_{11})]x_n = b_2 - a_{21}(b_1/a_{11})$$

Solution

One of the simplest and most efficient direct-solution methods is the Gauss elimination (named after the mathematical genius Carl Friedrich Gauss). The method is basically a systematic elimination process which continually reduces the size of the system, to finally produce one equation with a single unknown. The algorithm can be demonstrated on the general system (7) (or (8)), and the following numerical example:

$$\begin{aligned} 2x_1 + x_2 + x_3 &= 8 \\ 3x_1 - 2x_2 + x_3 &= 3 \end{aligned} \quad (9)$$

$$4x_1 - x_2 + x_3 = 6$$

Let us assume that $a_{11} \neq 0$. The first step is division of the first equation of (7) by a_{11} , resulting in equation 10, below, and for the special case (9)

$$x_1 + \frac{1}{2}x_2 + \frac{1}{2}x_3 = 4 \quad (11)$$

Next, we multiply the new (or modified) first equation (10) by (12) below, which for the case of (9) results in ($a_{21} = 3$)

$$3x_1 + \frac{3}{2}x_2 + \frac{3}{2}x_3 = 12 \quad (13)$$

Now we subtract equation (12) from the second equation of (7), eliminating x_1 as shown in (13a) below. We can denote the coefficients of the last equation as follows:

$$a_{22}^{(1)}x_2 + a_{23}^{(1)}x_3 + \dots + a_{2n}^{(1)}x_n = b_2^{(1)} \quad (14)$$

where the superscript (1) denotes the first cycle of the solution procedure. For our special case we get

$$3x_1 + \frac{3}{2}x_2 + \frac{3}{2}x_3 = 3 \times 4 = 12$$

$$\begin{aligned} 3x_1 - 2x_2 + x_3 &= 3 \\ \frac{7}{2}x_2 + \frac{1}{2}x_3 &= 9 \end{aligned} \quad (15)$$

Now we operate on the third equation of (7) the same way we did on the

Continued next page

second equation, that is, eliminate x_1 from it by multiplying equation (10) by a_{31} , and subtracting the result from the third equation of (7). For our special case we get ($a_{31} = 4$)

$$\begin{array}{r} 4x_1 + \frac{4}{2}x_2 + \frac{4}{2}x_3 = 4 \times 4 = 16 \\ -4x_1 - x_2 + x_3 = 6 \quad (16) \\ \hline 3x_2 + x_3 = 10 \end{array}$$

The process is repeated for the third equation, fourth, etc. For the special case, we have $n-1=2$ equations to be subtracted from the modified first equation, so the last operation in equations (16) ends the first cycle. Since we "got rid" of x_1 , we now have a reduced system of $(n-1)$ equations with $(n-1)$ unknowns, x_2, x_3, \dots, x_n .

The new system can be processed by the same procedure which was applied to the original system. That is, we divide the first equation of the new $(n-1)$ system by the new coefficient of x_2 , then multiply the result by the coefficient of x_2 in the second equation of the $(n-1)$ system and eliminate x_2 from it, then proceed with the third, fourth, etc., eliminating x_2 completely. The result will be a $(n-2)$ system. We repeat the process with the $(n-2)$ system, to obtain an $(n-3)$ system, and so on. After $(n-1)$ steps we eliminate all x 's except x_n . The last equation so obtained will be of the form

$$a_{nn}^{n-1}x_n = b_n^{n-1} \quad (17)$$

To see that, we proceed with our special case, equation (9), as follows. Our $(n-1)$ system consists of equations (15) and (16) with unknowns x_2 and x_3 . We divide equation (15) by $a_{22}^1 = 7/2$ to obtain

$$1x_2 + \frac{1}{7}x_3 = \frac{18}{7} \quad (18)$$

Now we multiply the result by $a_{32}^0 = 3$ to obtain

$$3x_2 + \frac{3}{7}x_3 = \frac{54}{7} \quad (19)$$

We subtract this equation from equation (16) and get

$$\frac{4}{7}x_3 = -\frac{16}{7} \quad (20)$$

After dividing equation (20) by the coefficient $-4/7$ we obtain

$$x_3 = 4 \quad (21)$$

Our operations on the $(n=3)$ system of equation (9) resulted in

$$x_1 + \frac{1}{2}x_2 + \frac{1}{2}x_3 = 4 \quad (11)$$

$$x_2 + \frac{1}{7}x_3 = \frac{18}{7} \quad (18)$$

$$x_3 = 4 \quad (21)$$

The third equation is the solution for x_3 .

Backsubstituting that result in (18) we get

$$x_2 = \frac{18}{7} - \frac{1}{7}x_3 = 2$$

Backsubstitution of both x_2 and x_3 in (11) results in

$$x_1 = 4 - \frac{1}{2}x_2 - \frac{1}{2}x_3 = 1$$

More generally, for the system of n equations, the form of the system after $(n-1)$ steps is

$$\begin{array}{l} x_1 + u_{12}x_2 + u_{13}x_3 + \dots + u_{1n}x_n = v_1 \\ x_2 + u_{23}x_3 + \dots + u_{2n}x_n = v_2 \\ x_3 + \dots + u_{3n}x_n = v_3 \\ \dots \\ x_n = v_n \end{array}$$

where we use u 's and v 's to denote the new coefficients that result from the operations performed on the equations during the elimination process. After obtaining this form, we need to use the backsubstitution to obtain $x_{n-1}, x_{n-2}, \dots, x_2, x_1$.

Now we need to tackle one last problem, the possibility of a zero coefficient by which we are supposed to divide an equation. For example, suppose that $a_{11} = 0$. In this case, we cannot divide the first equation of (7), to obtain equation (10). The same applies to any coefficient a_{ik}^j of a reduced system obtained by eliminating some unknowns.

For example, if in equation (15) we would have zero instead of $7/2$ as the coefficient of x_2 , we could not possibly divide it by zero. But we could interchange equation (15) and (16), since the former has a nonzero coefficient ($= 3$) for x_2 .

This is exactly what we need to do in the general case. That is, if we encounter a zero coefficient of x_i which is supposed to be a denominator of an equation, we search for a line that has a nonzero coefficient of x_i . This line is interchanged with the current line, and the process continues as before. Failure to produce candidate coefficients for all unknowns indicates that the system does not have a unique solution (it might not have any solution at all, or it may have an infinite number of solutions).

The Program

The program "Gauss" is designed to solve a system of linear equations and it includes the option for line interchange. The program indicates whether there is no unique solution. It should be noted that we use arrays A (the original coefficient matrix) and B (the right hand side of equation (7) or (8)) to store the modified coefficients during the elimination process. This results in memory conservation, but the original values are lost.

It should be mentioned that for small size systems the program works quite fast, but for large systems some modifications are necessary. After getting familiar with the program the user can introduce changes to enhance it. For example, variables for $(K+1)$ and $(N-1)$ should be defined and placed in the corresponding FOR statements. The counters in NEXT statements (e.g., NEXT K) should be removed. Statements should be concatenated to save space.

Examples

It is suggested that the three following examples be solved manually and verified by running the program:

- 1) $2x_1 + x_2 + 2x_3 = 10$
 $2x_1 + x_2 + 3x_3 = 17$
 $(x_1 = -5/3, x_2 = -2/3, x_3 = 7; \text{ a line interchange is required})$
- 2) $x_1 + x_2 + x_3 = 2$
 $0x_1 + x_2 + 0x_3 = 2$
 $0x_1 + x_2 + 0x_3 = 2$
 $(x_1 + x_3 = 0 \text{ is an infinite set of solutions, } x_2 = 2)$
- 3) $x_1 + x_2 + x_3 = 1$
 $2x_1 + 2x_2 + 2x_3 = 4$
 $0x_1 + 0x_2 + x_3 = 3$
 $(\text{no solution}).$

References

- Ayres, F., Jr., *Matrices*, Schaum's Outline Series, McGraw-Hill, 1962.—Excellent for the novice. Contains many examples.
- Fox, L., *An Introduction to Numerical Linear Algebra*, Oxford University Press, 1964.—Excellent for the more advanced reader.
- Ralston, A., and Rabinowitz, P., *A First Course in Numerical Analysis*, McGraw-Hill, 1978.—Chapter nine deals with systems of linear equations. This excellent book discusses many other topics of importance to the computer hobbyist, as well as the professional.

TECHNICAL TIPS

GAUSS

```

10 REM *****'BWRB
11 REM * PROGRAM GAUSS, VERSION I,
    BY SHLOMO GINSBURG, MAY 1984'BWJL
12 REM * THIS SOLVES A SYSTEM OF N
    LINEAR EQUATIONS WITH N
    UNKNOWN'S'BYLO
13 REM * IT NOTIFIES THE USER WHEN
    THERE IS NO SOLUTION'BOEM
14 REM * VARIABLES:'BLOE
15 REM * N      = NUMBER OF
    EQUATIONS'BUPI
16 REM * A(I,J) = ELEMENTS OF THE
    COEFFICIENT MATRIX I,J=1,2,...,
    N'BBAQ
17 REM * B(I)   = ELEMENTS OF THE
    RIGHT HAND SIDE (CONSTANTS)'BSMQ
18 REM * K      = STEP INDICATOR (A
    TOTAL OF N-1 STEPS IS
    REQUIRED)'BTQR
19 REM * R      = DIAGONAL ELEMENT BY
    WHICH EQUATIONS ARE DIVIDED'BTPT
20 REM * T      = TEMPORARY STORAGE
    FOR ROW INTERCHANGE'BLPJ
21 REM *****'BWRD
22 REM *'BBJA
23 REM *'BBJB
24 POKE 53280,11:POKE 53281,0'CQLG
25 PRINT"[CLEAR,RVS,GREEN,SPACE5]
    A SYSTEM OF N LINEAR EQUATIONS
    [SPACE5]";'BBOO
26 PRINT"[SPACE12]GAUSS ELIMINATION
    [SPACE11,RVOFF]"'BAWM
30 REM * BEGINNING OF PROGRAM -
    INPUT'BAEG
40 INPUT " [YELLOW]NUMBER OF
    EQUATIONS ([BLUE]N[YELLOW])";N'BCFI
50 DIM A(N,N),B(N)'BLLD
60 PRINT"[DOWN2] INPUT THE
    COEFFICIENTS OF [RED]A[YELLOW]
    "'BAEK
70 FOR I=1 TO N'DDIF
80 FOR J=1 TO N'DDJG
90 PRINT "[DOWN,SPACE2]A("I","J")";
    'BDVH
100 INPUT " ";A(I,J)'BHRW
110 NEXT J:NEXT I'CDIW
120 PRINT"[DOWN2] INPUT THE
    COEFFICIENTS OF [L. RED]B[YELLOW]
    "'BAWG
130 FOR I=1 TO N'DDIA
140 PRINT "[DOWN,SPACE2]B("I")";'BCEB
150 INPUT B(I)'BEVB
160 NEXT I'BBCB
170 IF N=1 THEN 540: REM SINGLE
    EQUATION'EULJ
180 FOR K=1 TO N-1: REM STEP
    COUNTER'FOLK
190 R=A(K,K)'BHMJ
200 REM * CHECK FOR ZERO DIAGONAL.
    INSTEAD OF ZERO WE USE
    1/1000000'BYSJ
210 IF ABS(R)>.000001 THEN 390
    : REM NO NEED FOR INTERCHANGE'FJII
220 REM * INTERCHANGE ROWS'BQSD
230 FOR J=(K+1) TO N'EGEC
240 IF ABS(A(J,K))>.000001 THEN 260
    : REM FOUND THE ROW FOR
    INTERCHANGE'FTFO
250 GOTO 350: REM KEEP LOOKING FOR
    ROW'CVBI
260 FOR L=K TO N: REM INTERCHANGE ROW
    J WITH ROW K - A'S'EGKN
270 T=A(K,L)'BHPF
280 A(K,L)=A(J,L)'BMPH
290 A(J,L)=T'BHOH
300 NEXT L'BHFW
310 T=B(K): REM INTERCHANGE B'S'CUTE
320 B(K)=B(J)'BIIB
330 B(J)=T'BFBF
340 GOTO 390'BDLC
350 NEXT J'BBDG
360 PRINT "[DOWN,RVS,RED,SPACE15]
    NO SOLUTION ! [SPACE12]"'BAOK
370 GOTO 700'BDGF
380 REM * DIVIDING ROW BY DIAGONAL
    ELEMENT A(K,K)'BKEP
390 R=A(K,K)'BHMI
400 FOR J=(K+1) TO N'EGEB
410 A(K,J)=A(K,J)/R'CNLD
420 NEXT J'BBDG
430 B(K)=B(K)/R'CEIE
440 REM * ELIMINATION OF X(K) FROM
    ROWS K+1, K+2, ... , N'BOOM
450 FOR I=(K+1) TO N'EGDG
460 R=A(I,K)'BHKJ
470 FOR J=(K+1) TO N'EGEI
480 A(I,J)=A(I,J)-R*A(K,J)'DTEM
490 NEXT J'BBDH
500 B(I)=B(I)-R*B(K)'DNPD
510 NEXT I'BBCA
520 NEXT K: REM END OF STEPS'CMTF
530 REM * LAST EQUATION FOR A(N,
    N)'BWVI
540 IF ABS(A(N,N))>.000001 THEN
    570'ESVJ
550 PRINT "[DOWN,RVS,RED,SPACE14]NO
    [SPACE2]SOLUTION ! [SPACE12]"'BAOL
560 GOTO 700'BDGG
570 B(N)=B(N)/A(N,N)'COWK
580 REM * BACKSUBSTITUTION'BRJM
590 FOR I=1 TO (N-1)'EGDL
600 K=N-I'CDMC
610 FOR J=(K+1) TO N'EGEE
620 B(K)=B(K)-A(K,J)*B(J)'DSTH
630 NEXT J:NEXT I'CDIE
640 PRINT"[CLEAR,DOWN2,RVS,GREEN,
    SPACE17]RESULTS[SPACE16]"'BAPL
650 FOR I=1 TO N'DDIH
660 PRINT"[DOWN,SPACE2]
    TOUCH ANY KEY TO CONTINUE"'BASN
670 PRINT"[DOWN,SPACE3]X("I") =";
    B(I)'BGPK
680 GET A$:IF A$="" THEN 680'EINM
690 NEXT I'BBCJ
700 END'BACB

```

END

Random Thoughts:

A Rainbow of Noise

A rainbow is a spectrum. Light bends when it goes through drops of water, and the different frequencies bend different amounts. That simple result has led to a mini-industry, spectroscopy. From a study of spectra, you can tell the composition of the stars as well as the make-up of tiny flecks of dust here on earth. The same principles apply to noise, random fluctuations. This month, we'll be exploring the different spectra that come up in random and non-random systems of all sorts: music, traffic jams, earthquakes and more.

Frequency Analysis

First, we need to learn a little of the language of spectroscopy. The key idea is frequency analysis. It's one of those obvious (after you've seen it), brilliant concepts that has tremendously far-reaching implications. Frequency analysis is sometimes called "Fourier Analysis," after the French mathematician and friend of Napoleon, Jean-Baptiste-Joseph Fourier who developed the theory in the early 1800's. To see what frequency analysis is all about, take a look at the pairs of graphs in Figure 1.

This figure shows some sketches of waves, plotted versus time on the left. To the right of each time plot, there's a sketch of what the frequency analysis of that wave gives for the power distribution. The term "power distribution" is very general. It could mean the actual energy in the waves (if they're electrical currents or ocean waves), or it could mean the mathematical analog of the power if the waves aren't physical.

These sketches aren't meant to be arithmetically precise (though don't hesitate to write if I've made a gross error in drawing them). Rather, the time-frequency pairs will help us develop some instincts about frequency analysis. Developing good instincts is the key to progress in any field of science. The goal is to be able to "guess"

This month, we'll be exploring the different spectra that come up in random and non-random systems of all sorts: music, traffic jams, earthquakes and more.

the answer, without having to laboriously solve the equations.

Fourier Instincts

There are several important things to note about the graphs in Figure 1. First, the power curves on the right have been plotted only for positive numbers and show only positive values. That makes sense. In ordinary life, "negative frequencies" and "negative power levels" don't occur. (There are exceptions in mathematics, in quantum mechanics and in science fiction!)

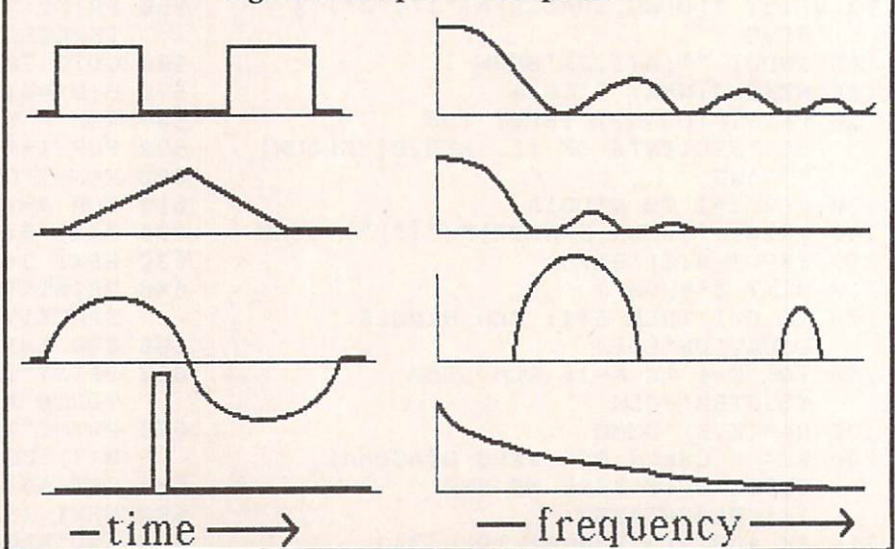
Second, look at the behavior of the power curves near zero frequency, at the low end of the spectrum. The zero-frequency behavior tells you something about how much area is

under the wave in the time plot. The power carried at zero frequency will vanish only if a wave is equally positive and negative. The third example with the sine wave shows a case of that happening.

Next, look for where the "bumps" are in the frequency plot, and notice how fast the power falls off as you go to high frequencies. The bumps in the power distribution tell you where most of the "action" is in the wave. The square waves in the first example have a big bump at low frequencies (because of the area under the squares) and then have "echoes" of that bump at multiples of the frequency given by the spacing between the squares. Musically, those "echoes" in the power plot are called harmonics. Square waves have sharp edges and lots of energy in their high-frequency harmonics.

The triangular wave shown in the second plot also has a lot of low-frequency energy due to its nonzero area. It has bumps at higher frequencies too, but they die off a lot faster than the square waves' did. That's because the triangular wave doesn't have any abrupt "jumps" in its graph. It takes a lot of high-frequency energy to make a wave jump suddenly! The abrupt corners in the triangle do take some high frequencies to define, but not nearly as much as a jump discontinuity would.

Figure 1. Sample Power Spectra



The smooth sine waves in the third example don't have any zero-frequency energy, because they have equal amounts of plus and minus in their wave. The sine waves' energy is concentrated in a peak around the fundamental frequency of the wave. There is a bit of energy in the harmonics, though, due to the cut-off of the sine wave I sketched out. If the wave went on for many cycles, most of the power would pile up in the fundamental frequency and the harmonics would go away.

Finally, the really narrow pulse shown in the last wave plot of Figure 1 has a power spectrum that falls off very slowly with increasing frequency. For the pulse I drew, there will be "bumps" and "echoes" like there were for the square waves, but they occur at much higher frequencies than are plotted in the figure. If the pulse got narrower and higher, the power distribution versus frequency would tend to get flatter and flatter. That leads us to our next topic...

Noise Spectra: White and Red

Frequency analysis as described above applies directly to the study of noise and other random phenomena. One just takes the noise signal, whatever it may be, and plots it (like the graphs on the left of Figure 1). Then the same methods of analysis work to transform that into a power spectrum. Figure 2 shows a couple of examples of noisy signals.

The first example could be the output of a typical random-number generator, set up to produce completely chaotic numbers between +1 and -1. You can see how the numbers plotted jump all over the place. On the average, such a random-number generator will have a flat frequency spectrum, as the power plot at the upper right shows. (This "spectral test" is, in fact, the most powerful technique known for checking out random number programs on computer!) A signal like this one is called "white noise," since it's made of equal amounts of all frequencies, just as white light is made of equal amounts of all pure colors.

The bottom half of Figure 2 shows a "random walk" like the one we discussed in this column last July. It's the

result of taking many tiny, unpredictable steps and adding them up. (Mathematically, this process is called "integration," and the random walk is the "integral" of the random number generator of the top half of Figure 2. So, now you know some calculus!)

Look at the power spectrum of the random walk. It's a curve that rises rapidly as you move toward zero frequency and contrariwise dies off fast toward the high frequency end. The shape of this curve is just $1/f^2$, where "f" stands for "frequency." There's a huge amount of power at the low-frequency end. In another analogy to light, this type of signal is called "red noise," since red light is the lowest frequency visible to the human eye.

You may want to think about why the power spectra in Figure 2 don't vanish at the zero-frequency end. Judging by what we said earlier, if the white or red noise signals were equally likely to be positive or negative, there should be no power at $f=0$. Yet the "white noise" power spectrum is flat there and the "red noise" power blows up.

The answer is related to the long-term drifts that the random signals generate. As you may recall, "random walks" tend to wander off by about the square root of the number of steps

taken. As the number of steps goes to infinity, odds are that the positive and negative parts of the walk will NOT cancel each other out after all. Meditate on that; I'll return to the subject in a future column.

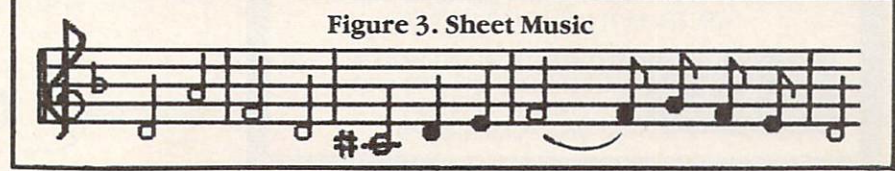
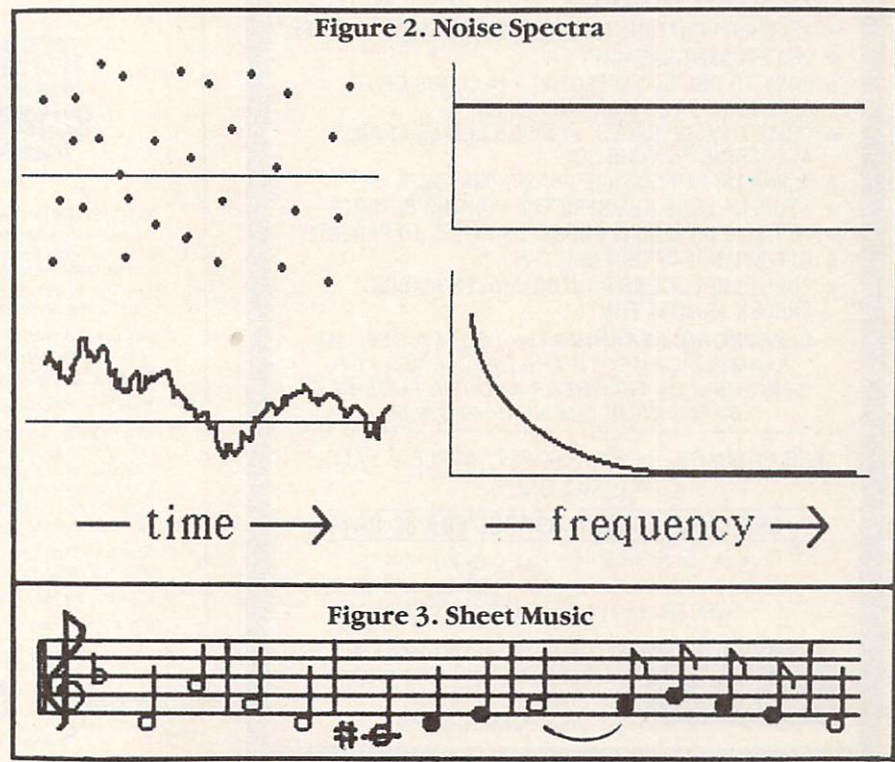
Pink Noise Everywhere

A power spectrum analysis can be applied to just about any type of signal. I've already mentioned an application for testing computer random number generators; if you want to read the gory mathematical details, see D. E. Knuth's *The Art of Computer Programming*, Volume 2. Applications outside of the narrow field of computing are even more fascinating.

When you listen to a piece of music, you hear the melody moving up and down. This is even clearer if you look at sheet music, as in Figure 3.

This is the theme from J. S. Bach's "The Art of Fugue." (No, Knuth's title isn't a coincidence. He's a fan of Bach's.) If you take the musical notes and do a frequency analysis of them, you'll probably get something between the white noise and the red noise examples of Figure 2. Appropriately enough, such a spectrum is called "pink noise."

Pink noise is technically referred to



TECHNICAL TIPS

as "1/f noise" (pronounced "one over eff"). As far as music goes, it's much more interesting to listen to than random walks of notes—a random walk sounds like a dull variety of Gregorian chant to our ears. On the other hand, pink noise is also more aesthetically pleasing than white noise. (Modern rock music is approaching white noise more and more as the years go by—is this significant?)

Pink noise doesn't occur just in a musical context. It's virtually everywhere, if you look closely enough. People have found pink noise in frequency analyses of tree ring thicknesses, the stock market, high-precision clocks, the floods of the Nile, the noise in amplifier circuits and hundreds of other places. Seismic noise grows like 1/f at low frequencies. Catastrophic traffic jams develop in a similar pattern. Take statistics on the insulin intake of diabetics over the years—you'll see pink noise!

Pink noise is ubiquitous. It seems to show up whenever you look at sequences of data over long periods of

time. The power spectrum may look like white noise or something else at the higher frequencies. But when observations continue, long term drifts or fluctuations always seem to give the spectrum a 1/f profile near the zero frequency end. This is still a great mystery. Researchers have some theories, but there doesn't seem to be any way to link together all these diverse areas where 1/f noise emerges.

Plans and Projects

We'll return to noise and spectral theory in future issues of *Commodore Microcomputers*. I plan to explore these subjects further than space allows this month. In particular, I want to talk about filtering in terms of frequency analysis. Filtering, in the most general sense of the word, has applications in information transmission, signal processing, image enhancement and lots more.

But meanwhile, I have a project (actually, several projects) to suggest for you to work on. If you make some progress on them, please write me,

care of this magazine.

The project is to develop a controlled random sound-production program. (You may think of this as "music" generation, if your program is good enough.) I did some work on this many years ago on my old 8K Commodore PET. But the PET's sound-generating facilities were primitive compared to what can be done on the 64 and other new-generation computers. Your program might allow you to use white, red or pink noise to control the tone patterns you output. You might experiment with different waveforms: pulse, square, triangular, sinusoidal, etc., and determine the power spectrum of those waves. You might try to use interrupts and machine language to allow your computer to whistle for you while you work, in a sort of time-sharing mode.

As you can see, the project is a rather open-ended task! Good luck. Let me know how you do. Readers who wish to correspond with me electronically can send mail to me on CompuServe or the ArpaNet. **C**

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SuperPET Potpourri

In the January/February issue, we promised to follow up on mail list problems in the next issue—and didn't. This issue, we keep the promise. On the way we peer at some dangers in Boolean expressions and discuss how to use the powerful but sometimes confusing GUESS... ADMIT... ENDGUESS statement found in all SuperPET languages, including assembly.

Mail lists pose several problems we didn't cover before. We've had a number of inquiries like this: "How do you keep personal notes—like phone numbers—on mail lists and yet not print the notes to labels?" It's a good question.

You may keep all the notes you need, on as many lines you need, right in your mail list—so long as you mark each "note" line with a special symbol. I use the bar "|" in the examples below. None of the "note" lines will print to printer if you make a few changes to DOALL (published in the January/February issue) to ignore the lines marked by "|" below:

e:12-3-86
| 203-441-8888
Ms. Honeychile Honeycutt
7700 Fauntleroy Drive
Dullsville, Kansas 23456
| Makes collect calls at 3 a.m.
Insomniac

e:11-2-85
John Baymes Popper
| Nickname: Bang
1900 Avenue Road, Suite 200
| Just off the Airport Exit on
Bayeau Road
Busytown, Ontario
Canada O5O 4Z1
| 555-1212-3333

Terrible temper!
e:12-12-84
Absalom O. Fitts
4567 Execrable Road
Tantrum, Oklahoma 33333
No phone. Mad at Phone Co.!

Creating a mail list program poses several problems. How, for instance, do you keep personal notes—like phone numbers—on the list and yet not print the notes to labels? And how can you do massive deletions when people's memberships expire? Here's how to take care of those problems.

As you can see, there's no limit to where the notes are put, or how many notes you make on any particular entry. You will print labels fastest if the "no-print" bar is the first character on a line, but it can be anywhere on the line, since we use "idx" to locate the bars.

Program DOALL, as listed in the January/February issue, is easily modified so it will not print such lines. See Listing 1.

The secret is absurdly simple. When we encounter a line containing a bar, we simply subtract one from i%, the loop counter, so that the line is overwritten by the next line taken from disk, whether null or text. We print only the lines not marked by a bar. Neither PASCAL nor FORTRAN will allow you to change the value of a loop counter (too darn many prissy rules, say we) but microBASIC will.

Coping with Expirations and Deletions

One of the major problems with all mail lists is massive deletion of entries (e.g., those no longer active in a group). It seems easiest for our purposes to do this by date of expiration, kept on the first line of every entry. I have simplified that line so it's only a date (without the usual gibberish on

zip codes, sex, age, occupation, etc.). I assume further that you won't take the time or money to print and mail notices of expiration with the usual return envelopes but prefer to have the expiration warning appear on the mail label itself, like this:

e:6-12-85 Membership Expired
Margaret Forgetful
22222 Delinquent Avenue
Fifth Notice, Arkansas 33333

You must modify DOALL's input section to ask if you want to print expiration notices on labels. If the answer is yes, you must input the month and year after which memberships expire, and set a variable, "warning%," to 1. If you do this, the changes to DOALL in Listings 1 and 2 will hide your private notes on the list and print expiration warnings on all labels for lapsing members.

A Digression on Booleans

In Listing 2, "proc warn" uses a long Boolean statement. Having shed a few buckets of blood over misused Booleans, I'm compelled to comment on them. Every Boolean statement must clearly yield a true or false answer, as the following one does:

if variable% or second variable%
Here, whatever follows the IF will execute if either variable is greater than zero. But—what happens to a compound Boolean, like the next one?

if variable and second_variable or third_variable
Be informed that it will run without an error signal, but it will *never* operate as expected. A true or false answer is impossible. Which of the forms below do we really mean? (Expressions within parentheses are evaluated first.)

if (variable and second_variable) or third_variable
if variable and (second_variable or third_variable)

Compound Booleans *must* be set off within parentheses to show how the expression is to be parsed. The two forms above are entirely different. The only compound Booleans which will run properly without parentheses contain OR's or AND's only, as in:

if w or x or y or z then ...
Our second warning on Booleans

concerns integer variables. A real (not integer) variable such as that below will execute code following the IF at any time the variable equals zero. An integer variable in the same form will almost always fail!

if not variable... (IF is executed if variable equals zero)

if not variable%... (IF is not executed if variable% equals zero)

Terry Peterson, of El Cerrito, California, told us why: microBASIC operates bitwise on integer variables used with Booleans. It doesn't simply test whether or not they are equal to zero. A "not variable%" makes every bit of the result the opposite of the bits within "variable%". Thus, zero becomes minus one and one becomes minus two. If we set x% to two and y% to eight, the result of "x% and y%" is zero!

Use integer variables in Boolean expressions with care! The one below, taken from Listing 2, will work okay because we compare values, but do not operate directly on the variables with AND's, OR's, or NOT's, and have parsed with parentheses:

if exp_year% (= year% and < exp_month% <= month% or exp_year% < year%)

To Make Up a New Mail List

As memberships expire you must, of course, delete names and addresses from the list itself. It's simple enough; amend "proc warn" in Listing 2 so that it sets a flag which won't allow any lapsed entry to be copied to a new disk file, but will require that any current entry be so copied. Such a copy program, which transfers only good entries to a new disk file, is easy to write. Be sure it dates the new mail list file! You should keep the old lists, for surely as the sun rises, somebody will write or call and say you made a mistake.

Having coped with expiration notices and massive changes to a mail list, we face one more problem: creating an alphabetically sorted list of the members. We can break this down into two smaller problems: getting a list of names which we can sort (Sarah Pidgeon isn't sortable, but Pidgeon, Sarah is!) and sorting the sortable list itself.

Any program written to create a sortable list of names, last name first,

depends upon the format of your mail list and how you use it, so I'll merely demonstrate the problems you'll have to solve by listing a few names:

Name Lines from List

Dr. Dextrous F.
Surgeon, Sr.
Bro. James Paul
McGinty
Mr. Prosper H.
Just, III
MAGAZINE!
Prof. Dr. August
Bosch, Jr.

Name Lines Converted for Sort

Surgeon,
Dextrous F., Sr.
McGinty, James
Paul
Just, Prosper H.,
III
MAGAZINE!
Bosch, August, Jr.

Your program obviously must cope with suffixes such as Jr. and III, title prefixes such as Dr. or Bro., single names, such as MAGAZINE!, and, despite them, must get the last name first. Do you want those names which

appear several times on your mail list also to appear on your sorted list many times? (Some organizations may get five copies; that means five mail labels.) I screen out multiple entries by comparing the previous "firstname and lastname" with the next entry and drop any duplicate.

GUESS... ADMIT... ENDGUESS

One structured form—the GUESS... ADMIT... ENDGUESS—will come in mighty handy when you write your "make a sortable list" program, as I show in Listing 3. If you don't know how GUESS... ENDGUESS works, check the explanation in Figure 1 before you look at Listing 3:

If any GUESS is right, or any ADMIT condition is accepted, execution jumps to the statement following

Listing 1. Changes to DOALL to Hide Notes Marked by "!" and for Printing Notice of Expiration

```
265 loop
270 found1%=0 : found2%=0      ! Set search string flags to zero.
275 for i%=0 to 7
280   input #25, bare$
285   if io_status then eof_flag%=one%
290   if eof_flag% then quit
295   if bare$="" then quit
* 296   if idx(bare$, "!")      ! Bar indicates data not to be printed.
* 297   i%=i%-one%            ! Reset i% to overwrite the line.
* 298   else
300     if idx(bare$, search1%) then found1%=one%
305     if idx(bare$, search2%) then found2%=one%
* 306     if i%=0 and warning% ! If we want notice of expiration,
* 307     call warn           ! Parse the first line for date and year.
* 308     else
310       list$(i%)=bare$+CR$
* 311     endif
* 312   endif
315 next i%
```

Changes to DOALL, as published in January/February, are marked by *
Line numbers match those of original program except at *

Listing 2. A Procedure to Determine and Print Expiration Notices on Mail Labels

```
1180 proc warn
1190   long%=len(bare$)
1200   dash%=idx(bare$, "-")-one%      ! Find first dash
1210   exp_month%=value(bare$(3:dash%)) ! Get month of expiration
1220   exp_year%=value(bare$(long%-one%:long%)) ! Get year of expiration
1230   if exp_year% (<= year% and (exp_month% (<= month% or exp_year% (< year%))
1240     list$(0)=bare$ + "            MEMBERSHIP EXPIRED!" + CR$
1250   else
1260     list$(0)=bare$+CR$            ! No, this one is paid up.
1270   endif
1280 endproc
```

The variables "month%" and "year%" are input by the user to select the month and year on which memberships expire. Assume they are month = 5, year = 85.

The sample expiration date shown at right Sample date: e:6-1-85
will aid in following the procedure above: Character positions: 12345678

SUPERPET USERS ONLY

ENDGUESS. There's an inverse form of GUESS...ENDGUESS in which you QUIT if the test condition is met. It's equally useful.

GUESS . . . ENDGUESS is a bit hard to follow at first, but soon becomes a powerful tool. Keep in mind two rules: 1) any QUIT requires that the next ADMIT be executed; 2) any correct guess (always indicated by a failure to QUIT), executes the code for that condition and then jumps execution to the statement following ENDGUESS. With this background, see how GUESS . . . ENDGUESS works when we must deal with those pesky prefixing titles (Dr., Ms., etc.) in Listing 3.


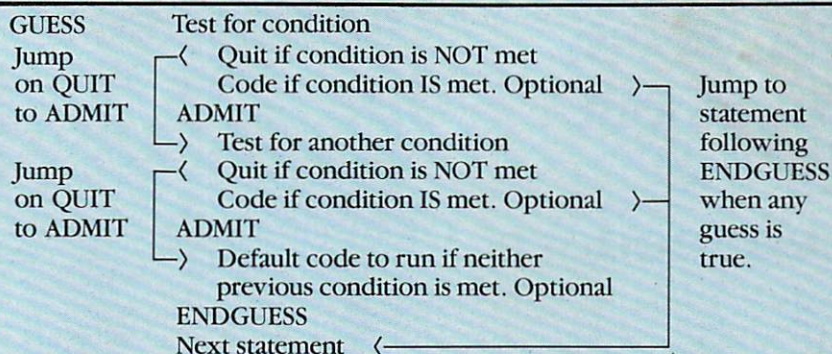
Once we have made a sortable list of names from our mail list, our only remaining problem is sorting it. Sorting on SuperPET is a subject in itself, which I'll try to cover next issue. For further information on the SuperPET, and on the International SuperPET Users Group, write me at P.O. Box 411, Hatteras, NC 27943. 

Figure 1. How GUESS . . . ENDGUESS Works



Listing 3. An Example of GUESS...ADMIT'...ENDGUESS in Screening Names

```

240   endd%:=len(b$)           ! I substitute b$ for name$ to get room for
245   guess                    ! comments. Assume b$="Ms. Good Example"
250   t%:=idx(b$,'Prof. Dr.') ! Character count: 12345
255   if t% then quit
260   u%:=idx(b$,'Mr.')       ! Any titles in the string?
265   v%:=idx(b$,'Dr.')
270   w%:=idx(b$,'Ms.')
275   x%:=idx(b$,'Mrs.')
277   y%:=idx(b$,'Bro.')
280   z%:=idx(b$,'Prof.')
285   if u% or v% or w% or x% or y% or z% then quit ! Yes, so ADMIT...
290   admit
295   if t% then b$=b$(1: endd%) ! Shoot the Prof. Dr.
300   if u% or v% or w% then b$=b$(5: endd%) ! Scratch Dr., Mr. or Ms.
305   if x% or y% then b$=b$(6: endd%) ! Divorce the Mrs., Bro.
310   if z% then b$=b$(7: endd%) ! Retire the Prof.
315   endguess

```

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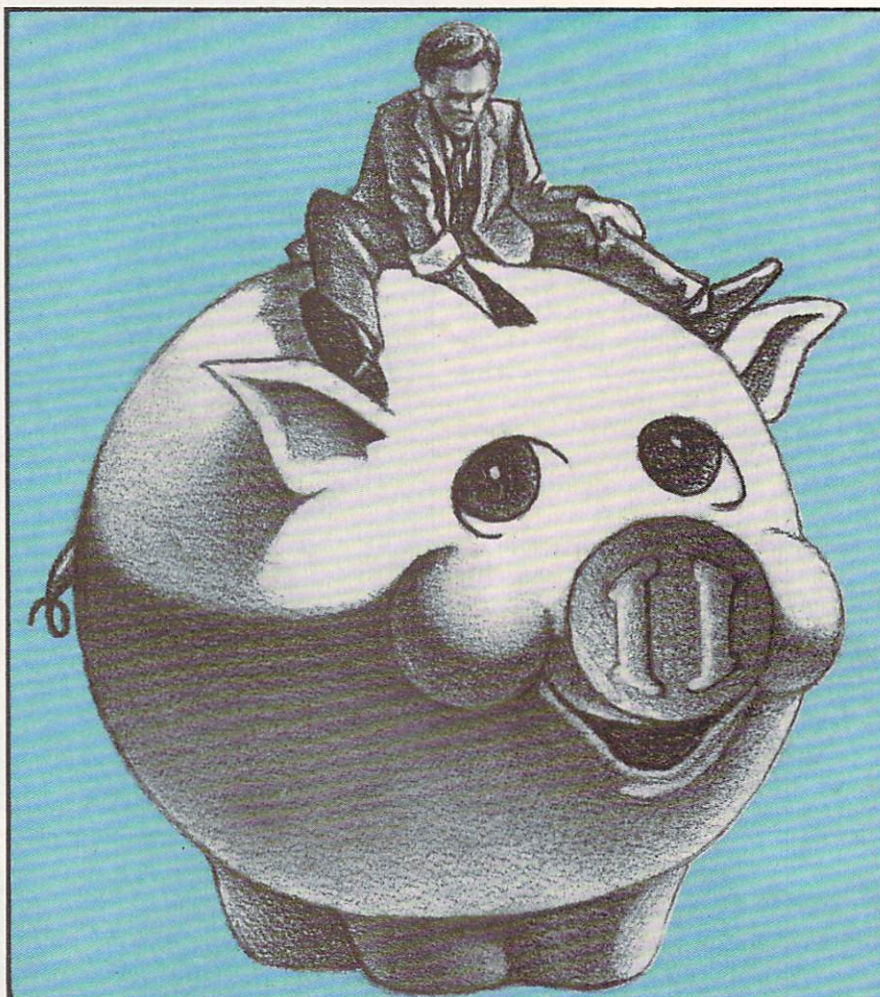
Net Worth Statement for the Commodore 64

For some people, calculating a net worth statement is put on the same level as going to the dentist or figuring out your tax returns. The truth is that having such a statement and analyzing it carefully can often be a very useful tool. In developing a good financial plan, it's important to know where you're at now before you can make plans for the future. A systematic calculation of your net worth is a good first step toward getting control of your financial life. A net worth statement can be a help in setting specific goals. For example, perhaps you should start an investment or savings plan or buy a home instead of continuing to pay rent.

Before you use the program, you should consider just what it is that you want to find out. Literally, net worth is what you could get in cash for your assets minus your liabilities at a given point in time. Usually this point in time is the present. But you could also use a net worth statement to find out what your estimated worth would be at retirement, if a relative leaves you their fortune or what your estate would be worth to your survivors. In essence, there are a multitude of things that a net worth statement can provide you with when you plug in the appropriate figures.

When getting together the figures for your statement, be sure to use the market value of the asset instead of its replacement cost. What something is worth if just the right buyer is found will probably bring substantially less if an immediate sale is needed.

To use the net worth program, simply load from tape or disk and run it. The program makes extensive use of loops, data and input statements. The calculations involve simple addition and subtraction.



STEVE EARLY

After the usual screen clearing and title display, the user is prompted to enter the name and address of the person for whom the statement is being created. If you will be using the program for personal use only, you could set these variables to a constant or, if you desire, omit them entirely. If you choose to omit them, then be sure to delete lines 840-860, also.

The program will then begin to display the data statements and prompt you to enter a dollar amount for each category. The first three categories are your current or liquid assets. If a category is displayed in which there is no amount to be entered, then enter a zero and the printout will not display that category.

After the program displays all of the pre-defined categories, you are prompted to list all your other cash value assets. This routine allows the user to define his or her own categories up to a maximum of ten entries.

First enter a brief description of the asset, then type a comma followed by the dollar amount. If you have less than ten categories, or none at all, simply enter a comma followed by a zero. The program will sense the entry and move on to the next routine. The program will then calculate your total assets.

The program will then move on to the liability section. The first input sequence is user-defined and works exactly like the user-defined section for assets. This first section should contain all the loans and debts that are due in less than a year or what are considered to be your current liabilities.

After this section, the program will display some pre-defined categories. As before, if no amount is to be entered then enter a zero and it won't be printed out on paper. The last section is user-defined and is for any other longterm debts. The program will

then calculate your total liabilities and move on to the printing routine.

The printing routine starts at line 830 with the opening of a channel to your printer. Lines 840-860 will center the name and address on a standard sheet of paper. The data statements are then restored and then the program begins to print out the categories along with the amounts that you have previously entered for each one. Lines 940, 1000, etc. insure that the amount that is printed will be extended to two decimal places. Thus \$10000 will be printed as \$10000.00.

Lines 950, 1010, etc. will suppress the printing of any category with a zero value. Lines 960, 1020, etc. calculate the length of each string and each dollar amount and format the printing so that the columns are aligned by their decimal point. This will give you a very professional-looking report.

A systematic calculation of your net worth is a good first step toward getting control of your financial life.

ing report.

Your total assets and liabilities are printed at the end of their appropriate sections and your net worth is calculated and printed at the end of the report. In addition, I've included a rou-

tine to calculate your solvency. A ratio of 1.00 or more indicates that your assets will cover your liabilities. Many lenders prefer that this ratio be based on your current assets and current liabilities. For this calculation, change line 1600 to read: $SR = A/L1$.

At the end of the printing routine, output will return to the screen. You will be asked if you would like another copy of the statement you just printed. If your answer is yes, be sure that your printer is positioned at the beginning of a new sheet of paper in order to avoid having the next copy printed on the same sheet that the first copy ended on. If your answer is no to the additional copy prompt, you will then be asked if you want to calculate another statement. If your answer is yes, then the variables will be cleared and the program will begin again.

Net Worth

```

100 POKE 53280,1:POKE 53281,1
    :POKE 646,6'DVYA
110 PRINT CHR$(147):FOR X=1 TO 9:PRINT
    :NEXT'HLVC
120 PRINT TAB(10);"NET WORTH
    STATEMENT"'CEEE
130 PRINT TAB(10)"-----
    "'CDWD
140 FOR T=1 TO 1000:NEXT'EHQC
150 ::'ACPA
160 PRINT CHR$(147):PRINT'DGGE
170 INPUT"NAME";N$:PRINT'CEQF
180 INPUT"STREET ADDRESS";E$
    :PRINT'CEGJ
190 PRINT"CITY & STATE (DO NOT USE
    COMMA AFTER"'BAMN
200 INPUT"CITY";U$'BDJX
210 DIM D$(38)'BGTX
220 PRINT CHR$(147):PRINT
    :PRINT TAB(13);"*** ASSETS
    ***"'FLUG
230 PRINT TAB(13);"-----"'CE
    KD
240 PRINT'BACA
250 PRINT"ENTER AMOUNT OF:"PRINT'CBSSG
260 FOR X=1 TO 3'DDVE
270 GOSUB 1690:INPUT A(X):NEXT'DKSG
280 A=A(1)+A(2)+A(3)'DNVI
290 PRINT:PRINT"ENTER VALUE OF:"
    :PRINT'DCKL
300 FOR X=4 TO 10'DEUY
310 GOSUB 1690:INPUT A(X):NEXT'DKSB
320 A1=A+A(4)+A(5)+A(6)+A(7)+A(8)+A(9)
    +A(10)'IHBK
330 FOR X=1 TO 10'DERC
340 GOSUB 1690:INPUT B(X):NEXT'DKTE
350 A2=B(1)+B(2)+B(3)+B(4)+B(5)+B(6)
    +B(7)+B(8)+B(9)+B(10)'KSBR
360 PRINT CHR$(147):PRINT'DGGG
370 PRINT"LIST OTHER CASH VALUE
    ASSETS."PRINT'CBUN
380 PRINT"ENTER ITEM NAME <COMMA>
    AMOUNT."PRINT'CB00
390 PRINT"USE [RVS]COMMA[RVOFF] [RVS]
    0[RVOFF] TO EXIT."PRINT'CBSN
400 Z=0:FOR X=1 TO 10'EHEC
410 PRINT"ITEM #";X;'BDVB
420 INPUT C$(X),C(X)'BKWC
430 IF C(X)=0 THEN GOTO 450'EIIF
440 Z=Z+1:NEXT'DECE
450 C1=C(1)+C(2)+C(3)+C(4)+C(5)+C(6)
    +C(7)+C(8)+C(9)+C(10)'KSMS
460 TA=A1+A2+C1'DISH
470 ::'ACPF
480 PRINT CHR$(147):PRINT'DGGJ
490 PRINT TAB(10)"*** LIABILITIES
    ***"'CDLN
500 PRINT TAB(10)"-----"
    :PRINT'DEDF
510 PRINT"LIST LOANS/DEBTS DUE IN
    LESS THAN A YEAR"'BAKL
520 PRINT"ENTER ITEM NAME <COMMA>
    AMOUNT."PRINT'CBOK
530 PRINT"USE [RVS]COMMA[RVOFF] [RVS]
    0[RVOFF] TO EXIT."PRINT'CBSJ
540 V=0:FOR X=1 TO 10'EHAH
550 PRINT"ITEM #";X;'BDVG
560 INPUT L$(X),L(X)'BKPH
570 IF L(X)=0 THEN GOTO 590'EIWK
580 V=V+1:NEXT'DETJ
590 L1=L(1)+L(2)+L(3)+L(4)+L(5)+L(6)
    +L(7)+L(8)+L(9)+L(10)'KSLX
600 PRINT CHR$(147):PRINT'DGGD
610 PRINT"ENTER REMAINING BALANCE FOR
    ":"PRINT'CBKK

```

Continued next page

64 USERS ONLY

```

620 FOR X=1 TO 10'DERE
630 GOSUB 1690:INPUT G(X):NEXT'DKYG
640 G1=G(1)+G(2)+G(3)+G(4)+G(5)+G(6)
   +G(7)+G(8)+G(9)+G(10)'KSGT
650 FOR X=1 TO 3'DDVH
660 GOSUB 1690:INPUT F(X):NEXT'DKXJ
670 F1=F(1)+F(2)+F(3)'DOPL
680 PRINT'BACI
690 PRINT"ENTER UNPAID TAXES FOR : "
   :PRINT'CBQDQ
700 FOR X=1 TO 4'DDWD
710 GOSUB 1690:INPUT T(X):NEXT'DKMF
720 T1=T(1)+T(2)+T(3)+T(4)'ESVJ
730 PRINT CHR$(147):PRINT'DGGH
740 PRINT"LIST BALANCES FOR OTHER
   LONG TERM LOANS."BAHQ
750 PRINT"ENTER ITEM NAME <COMMA>
   AMOUNT.":PRINT'CBOP
760 W=0:FOR X=1 TO 10'EHBL
770 PRINT"ITEM #";X;'BDVK
780 INPUT H$(X),H(X)'BKHL
790 IF H(X)=0 THEN GOTO 810'EINO
800 W=W+1:NEXT'DEVE
810 H1=H(1)+H(2)+H(3)+H(4)+H(5)+H(6)
   +H(7)+H(8)+H(9)+H(10)'KSRS
820 TL=L1+G1+F1+T1+H1'FMYK
830 OPEN 4,4'BDAG
840 PRINT#4,TAB(INT(80-LEN(N$))/2);
   N$'GPNM
850 PRINT#4,TAB(INT(80-LEN(E$))/2);
   E$'GPUN
860 PRINT#4,TAB(INT(80-LEN(U$))/2);
   U$'GPCO
870 PRINT#4:PRINT#4:PRINT#4'DFPL
880 RESTORE'BAOK
890 PRINT#4,TAB(32);"*** ASSETS
   ***"CGBQ
900 PRINT#4,TAB(32);"-----"
   CGGH
910 PRINT#4'BBDE
920 FOR X=1 TO 10'DERH
930 READ D$'BCNG
940 I$=STR$(INT(A(X)))+". "+RIGHT$
   (STR$(A(X)*100),2)'IXPR
950 IF VAL(I$)=0 THEN 970'EIEM
960 PRINT#4,TAB(5);D$;TAB(65-LEN(D$)
   -LEN(I$));I$'HWJS
970 NEXT'BAEK
980 FOR X=1 TO 10'DERN
990 READ D$'BCNM
1000 I$=STR$(INT(B(X)))+". "+RIGHT$
   (STR$(B(X)*100),2)'IXRD
1010 IF VAL(I$)=0 THEN 1030'EJPX
1020 PRINT#4,TAB(5);D$;
   TAB(65-LEN(D$)-LEN(I$));I$'HWJE
1030 NEXT'BAEV
1040 IF Z=0 THEN 1100'DGWA
1050 FOR J=1 TO Z'DDVA
1060 I$=STR$(INT(C(J)))+". "+RIGHT$
   (STR$(C(J)*100),2)'IXQJ
1070 PRINT#4,TAB(5);C$(J);
   TAB(65-LEN(C$(J))-LEN(I$));
   I$'HDKK
1080 NEXT'BAEB
1090 PRINT#4'BBDC
1100 PRINT#4:Q$="-----"'CEXW
1110 PRINT#4,TAB(70-LEN(Q$));Q$'EMPA
1120 PRINT#4,TAB(70-LEN(Q$));Q$'EMPB
1130 TA$="TOTAL ASSETS"'BDLB
1140 I$=STR$(INT(TA))+". "+RIGHT$(STR$
   (TA*100),2)'ITBH
1150 PRINT#4,TAB(5);TA$;
   TAB(65-LEN(TA$)-LEN(I$));I$'HYUI
1160 PRINT#4:PRINT#4'CDJB
1170 PRINT#4,TAB(30);"*** LIABILITIES
   ***"CGRH
1180 PRINT#4,TAB(30);"-----"
   ----"'CGDH
1190 PRINT#4'BBDD
1200 IF V=0 THEN 1250'DGYX
1210 FOR J=1 TO V'DDRX
1220 I$=STR$(INT(L(J)))+". "+RIGHT$
   (STR$(L(J)*100),2)'IXJH
1230 PRINT#4,TAB(5);L$(J);
   TAB(65-LEN(L$(J))-LEN(I$));
   I$'HDDI
1240 NEXT'BAEY
1250 FOR X=1 TO 10:READ D$'EHID
1260 I$=STR$(INT(G(X)))+". "+RIGHT$
   (STR$(G(X)*100),2)'IXCL
1270 IF VAL(I$)=0 THEN 1290'EJXG
1280 PRINT#4,TAB(5);D$;
   TAB(65-LEN(D$)-LEN(I$));I$'HWJM
1290 NEXT'BAEE
1300 FOR X=1 TO 3:READ D$'EGMY
1310 I$=STR$(INT(F(X)))+". "+RIGHT$
   (STR$(F(X)*100),2)'IXAH
1320 IF VAL(I$)=0 THEN 1340'EJTC
1330 PRINT#4,TAB(5);D$;
   TAB(65-LEN(D$)-LEN(I$));I$'HWJI
1340 NEXT'BAEA
1350 FOR X=1 TO 4:READ D$'EGNE
1360 I$=STR$(INT(T(X)))+". "+RIGHT$
   (STR$(T(X)*100),2)'IXDM
1370 IF VAL(I$)=0 THEN 1400'EJQH
1380 PRINT#4,TAB(5);D$;
   TAB(65-LEN(D$)-LEN(I$));I$'HWJN
1390 NEXT'BAEF
1400 IF W=0 THEN 1440'DGBA
1410 FOR J=1 TO W'DDSA
1420 I$=STR$(INT(H(J)))+". "+RIGHT$
   (STR$(H(J)*100),2)'IXBJ
1430 PRINT#4,TAB(5);H$(J);
   TAB(65-LEN(H$(J))-LEN(I$));
   I$'HDKK
1440 NEXT'BAEB
1450 PRINT#4:PRINT#4'CDJD
1460 Q$="-----"'BCRF
1470 PRINT#4,TAB(70-LEN(Q$));Q$'EMPJ
1480 PRINT#4,TAB(70-LEN(Q$));Q$'EMPK
1490 TL$="TOTAL LIABILITIES"'BDJM
1500 I$=STR$(INT(TL))+". "+RIGHT$(STR$
   (TL*100),2)'ITXH
1510 PRINT#4,TAB(5);TL$;
   TAB(65-LEN(TL$)-LEN(I$));I$'HYRI
1520 PRINT#4'BBDA

```


64 USERS ONLY

```

1530 NW$="NET WORTH":NW=TA-TL'DKRI
1540 IS=STR$(INT(NW))+". "+RIGHT$(STR$(
    (NW*100),2)'ITIL
1550 PRINT#4,TAB(5);NW$;
    TAB(65-LEN(NW$)-LEN(IS));IS'HYCM
1560 QS="-----"BCRG
1570 PRINT#4,TAB(70-LEN(QS));QS'EMPK
1580 PRINT#4,TAB(70-LEN(QS));QS'EMPL
1590 PRINT#4:PRINT#4'CDJI
1600 SR=TA/TL:SR=(INT(SR*1000+.5))
    /1000'HAXJ
1610 PRINT#4,TAB(5)"SOLVENCY RATIO
    IS";SR'CHGH
1620 PRINT#4:CLOSE 4'CDRC
1630 PRINT CHR$(147):PRINT'DGGF
1635 INPUT"ANOTHER COPY";ZZ$'BEPM
1640 IF LEFT$(ZZ$,1)="Y"THEN 830'EKNI
1645 INPUT"ANOTHER STATEMENT";ZZ$'BEQO
1650 IF LEFT$(ZZ$,1)="N"THEN 1670'ELDJ
1660 CLR:GOTO 160'CEUG
1670 PRINT CHR$(147):PRINT:PRINT:PRINT
    :PRINT"THANK YOU.":END'HKDP
1680 ::'ACPH
1690 READ D$(X):PRINT D$(X);'CMHL
1700 RETURN'BAQA
1710 ::'ACPB
1720 REM ** DATA FOR ASSETS **'BRLH
1730 DATA CASH ON HAND,
    CASH IN CHECKING ACCT.,
    CASH IN SAVINGS ACCT.'BYHR
1740 DATA SAVINGS BONDS,REAL ESTATE,
    CASH VALUE OF INSURANCE'BTVR
1750 DATA STOCKS,BONDS,
    AUTOMOBILE (S)'BBNM
1760 DATA PENSIONS,ANNUITIES,
    PATENTS & ROYALTIES'BLAQ
1765 DATA EQUITY IN BUSINESS
    VENTURES'BYBS
1770 DATA COLLECTIONS,JEWELRY FURS,
    FURNITURE,MACHINERY & TOOLS'BYTV
1780 DATA CLOTHING & PERSONAL EFFECTS,
    HOBBY EQUIPMENT,PROFIT
    SHARING'BDAX
1790 ::'ACPJ
1800 REM ** DATA FOR LIABILITIES
    **'BWXH
1810 DATA HOME MORTGAGE,
    OTHER REAL ESTATE,
    AUTOMOBILE LOAN (S),
    FURNITURE'BGQS
1820 DATA APPLIANCE LOAN (S),
    PERSONAL LOAN (S),
    EDUCATION LOAN (S)'BYJQ
1830 DATA DEBTS TO INDIVIDUALS'BRNJ
1840 DATA MEDICAL BILLS,DENTAL BILLS,
    RENT,UTILITIES,ALIMONY,FEDERAL,
    STATE'BLJW
1850 DATA LOCAL,INVESTMENTS'BRVL (END)

```

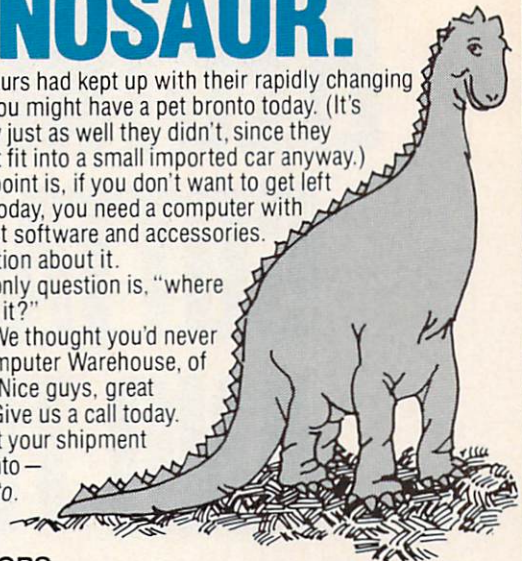
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THE ELECTRONIC COTTAGE AND THE SOFTWARE HIGHWAY

Whether we like to admit it or not, the microcomputers we use today are the Model T's of computing, whose real impact is yet to be felt. What will ultimately determine their impact is how well (or badly) we build the Software Highway.

BY KIEL STUART

Henry Ford's invention of the ingenious and solid Model T automobile eventually turned rural, bucolic America into a veritable pretzel of instant mobility, and it hasn't been the same for us since.

Today, the little home computer is un-bending that pretzel, but at the same time is sneakily twisting our lives around in a different way. Maybe right back to where it used to be before Ford.

"So what did the car do to us anyway?" you ask, few of you being old

enough to remember. It made us into one nation on wheels, indivisible, with fast-food joints and jump-starts for all. No longer were there two separate and distinct societies: the isolated farmers rooting around in the turnips, and the crowded, rowdy urbanites, never the twain to meet. Now, everyone lives everywhere, or, depending on your point of view, they really live nowhere at all.

Back in the good old days, Americans would go into debt to buy expensive cars they didn't really need and

certainly couldn't use properly, which broke their arms with clumsy crank-starters. They got stuck in the mud with their new cars and had to be pulled out by laughing horses and those equally merry turnip farmers. Get a horse, buddy, haw haw haw.

In the 1920's, American sociologists Robert and Helen Lynd ran around seeking new life and new information, and what they found out was that a lot of people would rather drive than eat. One woman owned a car, but had no bathroom. She had her priorities. The whole nation went wacko for wheels. It was a new technology, and we were all in love with the bells and whistles.

Auto hysteria has died down notably after decades of use, with some exceptions, like those of you out there who own hot cars (you know who you are). We take for granted the billions of miles of sleek black freeway built to handle jillions of cars per hour, and expect to get where we're going without having to be rescued by a horse. But once upon a time, gas stations were few and far between, the roads better suited for travel by camel. As roadways bloomed we expanded, delighted to be able to zip from one hamlet to another.

"So what's all this about computers? You said you were going to talk about computers," you yawn. Well, there's a new technology in our hands and we're head over heels for the bells and whistles. Some people would rather compute than eat—or sleep. But after the hysteria dies down, and we begin to take these new machines for granted, how will they have already changed our lives?

Joseph Cassius, a Memphis psychologist with his own radio call-in show, cautions against computer "mania." There can be problems with isolation, avoiding contact with humans. The person becomes like a computer, avoiding feelings. There are also those visual problems associated with staring at computer screens. Some people use computers now as a brain substitute, and, just like with video games, you can have stress but no adequate physical release. You even see computer workaholics, too," he points out.

But Jonathan V. Post, author of *Computer Futures* says, "Using computers can help make you into a generalist. It doesn't force you to become a specialist. They can be used by either left- or right-brain types. It helps cou-



ple the two hemispheres, and bring humans a little closer to the Renaissance ideal."

Daniel Kegan, a Chicago psychologist, adds another angle. "Computers are like any other tool. The more you understand them, the more you can use them," he says. "There's lots of unrealized potential here."

Which only means there are as many different views on what computers will do to us as there are different computer formats. Nevertheless, there's no denying that microcomputers can do a lot and much of it is genuinely helpful. Cassius points out that using them can give you better hand-eye coordination and immediate contact with information. "The realm of how one utilizes computers is limitless," he says. And you have only to glance at computer services like The Source and CompuServe to see what he means: stock market reports, news, weather, games, humor, thrills, romance—they're all there. In fact, there's much more than any one person could use.

But don't touch that dial. There is a computer museum in Boston, on Museum Wharf. Automatech Industries (South California) features "sewbots," robots controlled by microprocessors which sew pocket facings. (Will this lead to robot designerware—House Of Robby?) At Emory University in Georgia, robots hooked into personal computers "say ouch" when dental students get too rough, helping them develop the right touch without having to torture humans. Yale-New Haven Hospital and the University of Connecticut are medical facilities that have developed video games to educate child patients about asthma and diabetes. CAT scans and NMR (nuclear magnetic resonance) imaging both use our friend the computer, and one day long-distance computer consultants may reduce medical costs. A Los Angeles judge, Lester E. Olson, uses a computer for record keeping. You get the picture. Micros are all over the place.

Now, some people are almost as gleeful as those bygone farmers were over wedged-in cars when they hear a sad story about a crucial program dumped, lost forever in some electronic Twilight Zone. They're annoyed by the avalanche of computer-jargon, by the lack of compatibility among different computers, software, honks and tweets. RAM.ROM.BIT.BYTE. Some suspect

At Emory University in Georgia, robots hooked into personal computers "say ouch" when dental students get too rough, helping them develop the right touch without having to torture humans.

that the jargon-lovers, like automotive gear-heads, are a little insecure and want to feel as if they're part of a mystic society that only the elite can enter.

This may explain why John Bear's book, *Computer Wimp* is one of B. Dalton bookstore's best sellers about computers. It's a great read for anyone feeling the least bit intimidated by jargon, lack of standardization and assorted other evils.

When it comes to the question of standardization, Bear feels the situation is getting worse, not better. "The Japanese have their MSX standardization system, and when I was in Great Britain, they were all saying, 'Well, what are you Americans doing about it?' But compatibility stuff doesn't work perfectly. Even if it's 99% effective, how would you like to have wolves at your door, with the door only 99% closed?"

He is not optimistic about ever having the kind of sweeping standardization for computers that there is for, say, long-playing records. "We'll get standardization only when companies get together, and that doesn't seem likely," he says. "There's too much resistance by consumers to switching machines. They already have their computers—so why? It's also too easy for anyone to start up a computer business in their garage. It's not like tooling up for a refrigerator company where you *have* to conform to certain standards."

Cheer up, though. Bear points to the dim past of the automotive industry. "That's where cars are a good analogy to computers. It took 25 to 30 years for car manufacturers to sort out where the steering wheel would go, what kind of fuel cars would use, whether they'd be steam- or electric-powered."

Can it be that we're all just waiting for that reliable, cheap, any-color-long-as-it's-black home computer that won't get stuck in the mud, for the next step in human evolution? Let's take that analogy one step farther. Can roads be likened to software? I'm talking about the Software Highway that could change our lives as dramatically as those miles of blacktop did—except in the opposite way. Instead of taking us out of our homes, it will put us back in them. America won't need to go anywhere in cars once this new Highway rolls by. Everything will come to you, right in the comfort and safety of your own home.

Service Systems Technology (California) offers TINA International Message Service, for instance, which can be used to exchange messages or articles or scribbles on personal computers worldwide—costing five percent of what Telex costs at 20 times the speed. CompuServe offers all sorts of video banking by personal computer, 24 hours a day, via local phone call and modem. The Source allows you to trade stocks with your home computer. And "smart" credit cards containing a microprocessor (already popular in France) could be sneaking into your wallet here soon.

If staying home is a necessity rather than a desire, then a computer can be a lifeline to the rest of humanity. Dr. David Rabin, an endocrinologist at Nashville's Vanderbilt University, continued his writing and lab work on a specially-designed computer, even though he was almost completely paralyzed by Lou Gehrig's disease. The machine could be operated by one mechanical switch, which Rabin used with his left eyebrow. He could scan the computer's 1,300-word vocabulary, switch from alphabet to word mode, and start and stop it. With this set-up, a printer and a voice synthesizer, Rabin worked on his last book, *To Provide Safe Passage*, until his death in October, 1984, at age 50.

Using the Software Highway, we may, ironically, come full circle, back to working where we live—only now we won't all be rooting up turnips. Some of us will be doing scientific work, or company bookkeeping, or designing. But speaking of turnips, the farmer who once laughed at the auto now has his own computer magazine, *The Farm Computer News*. Editor Gary Vincent says, "Farmers use computers for all the general purposes, like book and record keeping.

The uniqueness comes from the profession of farming. There's software designed for special agricultural uses."

He also notes that computer automation of farms, while not yet common, is on its way. "Larger dairy farms have totally automated cow feeding systems using a cow necklace with transponder, which triggers feeding when the cow steps in her stall," he says. Now in research: ways to monitor milk production and the cow's health, using the same sorts of collars.

The Software Highway could bring a whole new meaning to things like industrial espionage. Who's going to bother putting on a cloak and dagger just to creep into the den and flip on the computer? Takes the fun right out of it. Vandalism will be a lot neater, too. What tyke needs to smash windows and spray-paint graffiti on your car when he can empty your bank account and leave you flapping in the breeze at the touch of a few buttons. No kid's going to risk getting laughed at for being old-fashioned enough to go out and bust things up. Heck, that's hokey. That's for Wally and The Beav. The young thug of tomorrow will not ride a getaway vehicle with wheels when a daisy wheel will do.

"Well, that's just dandy for hoodlums," you sneer. "But what about us

"Smart" credit cards containing a microprocessor (already popular in France) could be sneaking into your wallet here soon.

good citizens?" There, there. Staying down on the farm for the rest of your life might not be so bad. Think of all the gas you'll save, all the crowded shopping malls you'll skip, once the Software Highway has been poured. It won't be scary. You already shop by television for such indispensables as the Slash 'N' Mash Kitchen Implement, and "Sea Chanty Hits" sung by Sailor Willie and The Earth Worm Choir. Radio was the automobile's handmaiden. TV will serve the computer. Maybe you can even shop for computers by computer.

And getting that computer gives you the key. Author Post, who has worked with NASA, feels that by century's end, 12% of the Gross National Product will be in computers. "By 1999, a billion people will have some access to computer resources," he says. "This can only happen through

micros." He also foresees more memory for your dollar: "A megabyte for a buck," he predicts.

But what about Big Brother? While Post thinks that the existence of a national data bank would need careful legislation, he also feels that free information fosters a free society. Others are not so happy with the idea of computer data about your bank account, habits and vices floating around out there. Says psychologist Cassius, "It's going to affect how we control people—how the government controls people."

Rampant computerization certainly could also mean bizarre social changes that we can't predict, yet. Who would have thought, for instance, that the innocent little Tin Lizzie would contribute to sending our divorce rates to the moon, our kids off to live in distant towns, or give us the Bi-coastal Kind of Guy?

These days we still have all sorts of social interactions at work. Will working at home rob us of that? Will singles bars then boom, at last giving you a use for that mood ring you never threw out?

Think. A remote system, linking you to virtually any person or any service in the world. All at your fingertips, from technical specs for electronic circuits to recipes for gingerbread. But no touching. Contact without contact.

"We're entering a period of change," says Cassius, "and we might be in for a rude awakening. It could lead to a backlash—an expansion of humanism and religion, causing the brain to become devalued, like the human arm was after the Industrial Revolution, because the people who lack computer experience could feel inadequate."

Robert Mittman of California's Institute for the Future, sees a potential fragmentation of society into the computer literate and the computer illiterate. (Aha. A new class of snobbery is born.) That could occur, he thinks, if not all colleges and schools have equal access to computers. "Beverly Hills might have computers in each classroom," he says. "Watts might not."

But face it. Every kid you know loves computers. They live and breathe computers. Being unplugged so they can't commit War Games is their most feared punishment.

Or is it? Maybe. Engineer Howard

Continued on page 115

FUTURE FLASH! NEW GROUP LINKS ELECTRONIC COTTAGES THROUGHOUT THE WORLD

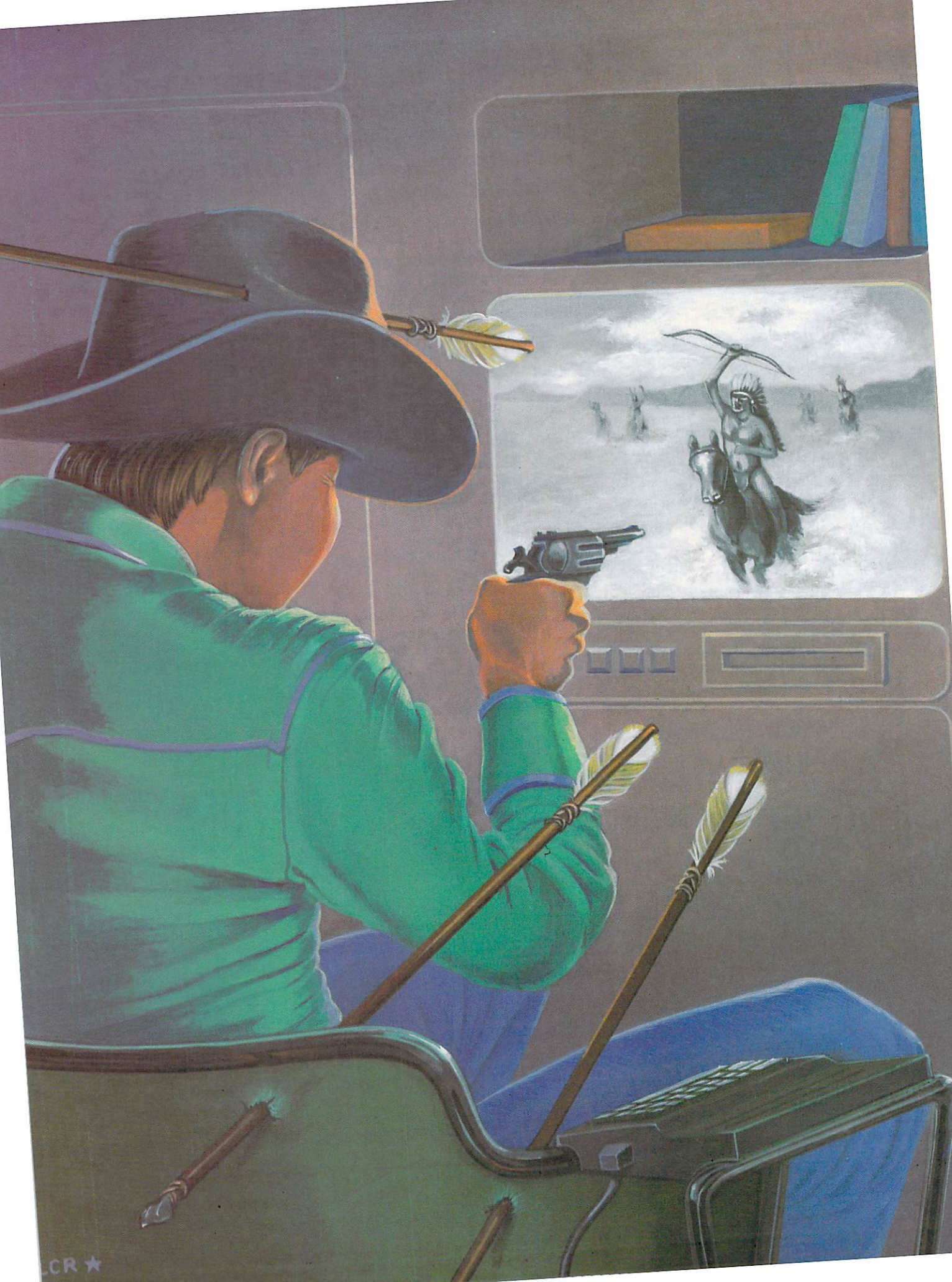
In January of this year, a new organization was formed to support the growing number of people who work in their homes with personal computers. Called the Association of Electronic Cottagers (AEC), the group provides business services to both at-home entrepreneurs and "telecommuters" (company employees who work at home).

Members of the group can obtain marketing assistance and business consultation, access up-to-the-minute news about developments affecting their interests, and use on-line bulletin boards, electronic conferences and private data bases. Aspiring cottagers can get help finding work at home and assistance in setting up a computer-based business.

According to an AEC news release, electronic cottagers are already mobilizing to protect their right to work at home by opposing AFL/CIO efforts to ban telecommuting.

If you are interested in the AEC, write for free information: Association of Electronic Cottagers, 677 Canyon Crest Drive, Sierra Madre, California 91024.





INTERACTIVE ENTERTAINMENT

No longer will you be at the mercy of the people who create books, movies and TV shows. Thanks to home computers, we are beginning to gain control of these media—to participate in their creation. This is not pie-in-the-sky conjecture. It's happening.

BY DAN GUTMAN

It used to be that you could sit down in front of the boob tube and watch a ball game, like a beached whale with a beer in its hand. It wasn't long ago that you could curl up with a good book or lie back and enjoy a good movie without lifting a finger. Well, it's starting to look like those good old days are coming to an end. There's a silent revolution creeping around—the interactive revolution. Literature is becoming interactive. Movies are becoming interactive. Television is becoming interactive. There's going to be a dramatic change in the way we entertain ourselves, and we can thank—or blame—the computer.

Reading and watching TV and movies have always been passive experiences. You don't have to do anything. You just sit there and get entertained. It doesn't take much effort, you don't have any input and everybody has been pretty happy with this arrangement. When you watch a movie, for instance, you just sit back and absorb the pictures and sounds that the director has selected to wash over your senses. You can close your eyes or walk out of the theater, of course, but that won't have any effect on what happens on the screen. You're pretty much helpless.

But not for long. Microprocessors are changing everything. If a com-

puter can store thousands of pieces of data and retrieve them instantly, that means we can *interact* with the media. Do you know what that means? We're not just talking about playing *Zork* here. It means we are no longer just passive observers! We can play a part in the creative process. We all will get the same stimulus, but each of us will mold it in a different way. We can have two-way communication with books, films, videos and television. This is a dramatic change in the history of entertainment.

Interactive Motion Pictures

When the interactive arcade game *Dragon's Lair* came out a few years ago, everybody saw it as the successor to *PacMan*. But it was more than that. History will remember *Dragon's Lair* the same way it remembers Al Jolson and The Jazz Singer. While playing *Dragon's Lair*, we were watching a motion picture and we were *interacting* with it. That had never been *done* before! You didn't just sit back and watch the movie, you actually played a *part* in it. And every move you made influenced the plot of the film.

Dragon's Lair was a cartoon, but the same thing can be done with photographic motion pictures. Instead of interacting with Dirk the Daring, we could be interacting with Burt Rey-

nolds, Indiana Jones, or even Linda Lovelace. As you ponder the possibilities, Hollywood is doing the same thing. Interactive motion pictures are coming.

Interactive Television

Hollywood may get beaten to the punch by interactive television, which is showing its first signs of life. Last year we saw *Scene of the Crime*, a murder mystery in which viewers were challenged to figure out whodunnit. HBO produced *Braingames*, an educational series that created puzzles, memory tests and other interactive games for children. *Nightwatch* (CBS) and *The New Tech Times* (PBS) encouraged their viewers to interact with the shows through national information networks like The Source and CompuServe. One night David Letterman had his studio audience vote on which opening theme song they'd prefer and his show opened with the theme from *Bonanza*!

The age of genuinely interactive television hasn't really started, but it's on the way. Television sets are getting smarter. Already we're starting to see TV's that allow you to break the screen into several "windows" in order to watch more than one channel at the same time. *Intermetall*, a West German subsidiary of ITT, is producing microchips that will put computer brains into regular television sets. According to a recent article in *Discover* magazine, this will allow us to control slow motion, freeze-frames, zooms and instant replays. Can you imagine what it would be like to watch a football game when you're choosing all the camera angles and directing the show yourself? Can you imagine an exercise show in which different people receive different exercises depending on what they weigh? Can you imagine watching a golf tournament and selecting which player you want to follow around the course? It will happen. You'll even be able to choose which commercials you'll see.

The technology for interactive television is here, but economics is slowing it down. Last February, computer pioneer Nolan Bushnell announced a stab at it—ACTV (as in "active"). It's a small box that attaches to a television set and does much the same thing as the *Intermetall* chips. ACTV hasn't gotten off the ground yet. The punch may have to come from the television manufacturers themselves. Sony is

making a new set with an attached keyboard and on-screen calendar and memo pad. Once these companies start putting real computers into their sets, interactive television won't be far behind.

Home video is also going interactive. Parker Brothers recently released *Clue: The VCR Mystery Game*. Armchair criminologists get to watch a crime in progress and figure out the motive, where the weapons are and who committed the crime. *Science Digest* magazine's Dr. Crypton developed a video puzzle titled *Treasure*. Somewhere in the United States he has hidden a statue of a horse that's worth half a million dollars. The videotape contains all the clues to find it, but it's still out there somewhere.

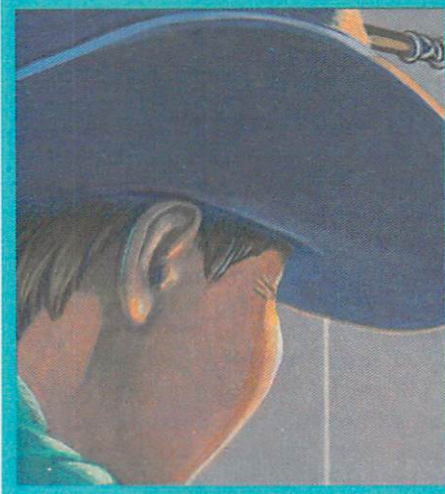
Video cassette recorders are a means of interaction in themselves. We no longer have to watch a TV show or movie when ABC decides to broadcast it. We can watch it any time we'd like, thank you. It's another example of how the person who is being entertained is taking more active control over the entertainment. We like the idea of having control over our television sets.

It won't all happen overnight, but interactive television will have enormous impact on sports, education and even voting. Do you remember when Eddie Murphy asked us to call up Saturday Night Live and vote on whether or not Larry the Lobster should be boiled on the air? Millions of people called in to cast a ballot. Perhaps someday we'll vote for President the same way. (Incidentally, Larry was boiled.)

Interactive Literature

The success of Infocom's all-text games (*Zork*, *Deadline*, *Suspect*, etc.) has shown that literature is well suited to an interactive format. The Infocom "interactive fiction" is just like reading a regular book, and it's nothing like it at all. Both use words to create characters and stories, but traditional books (as we learned in school) have a well defined beginning, middle and end. The story takes the reader from point A to point B the same way this sentence has taken you from "The" to the period at the end of this word. A traditional book manipulates the reader. An interactive book lets the reader manipulate it. It's up to you to decide whether a character looks behind the rock, puts the key in the door or takes the left fork in the road.

Can you imagine what it would be like to watch a football game when you're choosing all the camera angles and directing the show yourself? Can you imagine an exercise show in which different people receive different exercises depending on what they weigh?



Interactive books may never have the complexity of a regular novel. The novelist almost has it easy. He or she only has to come up with one outcome for every situation in the book. On the other hand, an interactive novelist has to have a response for every possible statement a reader might type on that keyboard at any time during the story. There simply isn't enough memory in a floppy disk (or a writer's brain) to create interactive fiction that has the depth of a novel.

But interactive books can do some things regular books can't. You read the story *dynamically*. You can go wherever you want and manipulate objects along the way. Your actions influence how the story progresses. Things may happen even if you do *nothing*. For instance, if you don't sit down on the couch at the beginning of Infocom's *The Witness*, you'll get shot and the game will be over.

You can even have a conversation with characters that exist only in fiction. Imagine if Mark Twain had been able to write an interactive Huck Finn. What would you ask Huck, Jim, Becky or Aunt Polly? If you thought curling up with a good book was engrossing, wait until you sink your teeth into a good *interactive* book.

Unfortunately, there aren't many good interactive books—yet. Most of the first efforts have been written by computer programmers, not writers. Trolls with axes and Dungeons & Dragons have their cult following, but leave most of the population with drooping eyelids. As a result, the current crop of text adventures rely more on solving word puzzles than on plot and character development. It will take a few big names to jump in—the Micheners, the Puzos, the Stephen Kings—before interactive literature really takes off.

But that's happening. As you might expect, the science fiction writers have been the first to embrace this new technology. Telarium (a division of Spinnaker Software) has lined up heavyweights Robert Heinlein, Ray Bradbury, Arthur C. Clarke, Michael Crichton and Alan Dean Foster to turn some of their successful books into interactive adventure games. Epyx has released Isaac Asimov's *Robots of Dawn* on disk at the same time it sits on the New York Times Bestseller List. Infocom has teamed up with Douglas Adams, who wrote the phenomenally successful *Hitchhiker's Guide to the Galaxy*, to make that classic book interactive. Some of these authors worked on the interactive translations themselves, others just lent their names and book titles.

Like movies and television, interactive literature is coming. The fact that book publishing giant Simon & Schuster is distributing the interactive *Hitchhiker's* in book stores should make other authors sit up and take notice. When the non-science fiction writers go interactive, watch out! I'd be willing to bet that if Stepehn King wrote his next book as an interactive novel—and *only* as an interactive novel—millions of people would run out and buy a computer just so they could read it. That's what it will take to fill American homes with computers—a piece of software that is compelling enough to give people a reason to buy one.

Interactive literature is growing in all directions. Groups of people are

hooking their computers together over telephone lines. Twenty-five people in Texas recently collaborated on a Gothic novel. A bunch of people in New Jersey are writing an ongoing soap opera. In this new medium, the rules of literature are different. Authors can create characters and take the story anywhere they'd like it to go—just as long as they don't kill off anybody else's characters.

In the 1400's, Gutenberg put letters on individual blocks of wood so they could be moved around and printed on a printing press, instead of written by hand. This revolutionized literature—it took it away from the priests and elite and gave it to the masses. Today, a bunch of housewives can get together, write a book on their computer screens and have it read by 100,000 CompuServe subscribers the same day. Isn't this just as startling as the invention of movable type? The computer is the electronic printing press of the future.

The Interactive Future

If it all sounds a little overblown, it is. Today's interactive literature is still in the cave-drawing stage. Sure, we can turn *Romeo and Juliet* into an adventure game, but it will probably play like...

Computer: *Romeo, Romeo, wherefore art thou, Romeo?*

You: *I'm right there, below the balcony, throw down the rope!*

Computer: *You do not see any rope here.*

Really chokes you up, doesn't it? Today's all-text games boast a vocabulary of as many as 1,000 words. So does your average two year-old child. But there's another revolution brewing that will allow interactivity to take a quantum leap over what we have today.

At the Winter Consumer Electronics Show in Las Vegas recently, a company called Denon demonstrated a new method of computer data storage using compact discs—those same discs that are revolutionizing the way we listen to music. These "CD-ROMs" store the equivalent of 500 to 1,000 floppy disks—275,000 pages of text or high-resolution graphics on a five-inch disk!

Imagine the possibilities of interaction. It would make *Dragon's Lair* look like *Pong*! You could put all the books in the library on a couple of disks, including both still and motion pictures. You could look up "World

How will this new interaction change art? When you interact with a book, television show or motion picture, aren't you taking away some of the control from the writers and directors? Does Stephen King or Steven Spielberg want us to decide what will happen to their characters?



War II" in the encyclopedia and not only read about it, but see films of it as well. You could take a simulated drive around any city in the world.

It will be a few years until compact discs are regularly used for computer storage, but it's going to happen. Do you remember when electronic calculators were big, expensive and hard to find? Now they're as thin as credit cards and practically given away for free.

The Birth of a New Medium

Any new kind of technology has its drawbacks. Do we really want to go blind reading books displayed on green phosphor monitors? Will this new human-computer interaction eliminate the need for human-human interaction? How will we plug in our computers to read our interactive books on a subway or bus? And what if we don't *want* to interact, anyway?

What's wrong with sitting in front of the boob tube watching a football game like a beached whale with a beer in its hand and letting *ABC* pick the camera angles?

How will this new interaction change art? When you interact with a book, television show or motion picture, aren't you taking away some of the control from the writers and directors? Does Stephen King or Steven Spielberg want us to decide what will happen to their characters? Maybe they'd rather make those decisions without our help.

What if this new interactive entertainment kills off the passive entertainment we know and love? Remember what happened to silent movies when talkies were invented? Remember what happened to monaural records where stereo was invented? Will our enormous body of books be taken out of libraries and put behind display cases in museums? Will we someday look upon *Casablanca* as a primitive film? Will our children find books and movies from "the good old days" to be boring, because they can't interact with them?

As Douglas Adams says, "Don't panic!" Silent movies and mono records are no more, but keep this in mind—radio didn't kill off books, movies didn't kill off radio, television didn't kill off movies, and computers probably won't kill off television (in fact, computers are making television more advanced than ever before). Each new medium has given us a new way to entertain ourselves, but we still enjoy all the old ways.

Our grandparents saw the birth of radio and motion pictures. Our parents saw the birth of television. If you're over 25, you've already seen the birth of high fidelity—stereo sound, sophisticated audio systems, the Walkman and the compact disk player.

Now we're seeing the birth of this *interactive* machine—the computer. It's not even ten years old yet. At the same age, motion pictures were first discovering close-ups, panning and other techniques that seem so elementary today. If computers evolve the way motion pictures have evolved from *The Great Train Robbery* to *Return of the Jedi*, it won't be long before we'll be able to walk right through the screen. **C**

W

ith so many hardware and software graphics packages on the market for the Commodore 64, it's hard to decide which is right for you. More often than not, a software package will work with only one type of graphics tablet, light pen or other control device. Moreover, you usually can't even display a friend's creations on your system if he or she used a different brand of software. To make the choice even more difficult, the range of features and capabilities varies a great deal from one manufacturer to another. The computer graphics scene, for the most part, is an electronic Tower of Babel, with each brand of software and hardware speaking its own language.

That's why it's good to see a departure from the norm in this muddy pool of graphics products. Two of the manufacturers whose products are covered here have decided that it is better to be *compatible* with other popular graphics products than to stand alone. While being compatible has its advantages, being *interactive* with other products is even better. Interactivity allows you to combine the best features of all the components, rather than having to settle for a less-than-perfect compromise. Finally, we've entered the age of videographics.

Videographics

For lack of a better name, I've coined the term "videographics" to describe the combination of components reviewed here. While there are several hardware/software options that can be used, my system consists of these items:

- Commodore 64 system
- Computereyes Video Acquisition System
- Hitachi VK-C500 Color Video Camera
- Flexidraw Interactive Light Pen and Software
- Flexifont Interactive Penware

Other optional equipment that may be used with these products are as follows:

- With Computereyes:
 - KoalaPad (from Koala Technologies)
 - Doodle! (from City Software)
 - Cardco Super Utility Programs (from Cardco)
 - The Print Shop (from Broderbund)

- With Flexidraw/Penware:
 - Micron Eye Digitizing Camera (from Micron Technologies)
 - U.S. Commodore Users' Group Flexidraw Symbol Libraries
 - Batteries Included Word Processor, PaperClip

I'm sure we'll be seeing more com-

patible and interactive products in the future now that the ice has been broken. But for now, let's take a look at what you can do with a setup such as mine.

Computereyes

With Computereyes, Digital Vision has done an excellent job of perfecting a digital video interface for the Commodore 64. The compact unit is only slightly larger than a pack of cigarettes and plugs into the user port of the computer. The interface has two adjustment knobs on the left side. One is for controlling the brightness of the image, while the other adjusts the synchronization signal from the video source. The right side of the box has an RCA-type jack for input of the video signal.

System software for the unit is supplied on disk. Additional software for *Doodle!* compatibility is also available from Digital Vision to custom-configure it to these products.

Computereyes allows you a great deal of flexibility for using a video source. You can use a video camera, videocassette recorder or videodisc player for input. Setting everything up takes only a few minutes and the procedure is simple. With the power off, the Computereyes module is inserted into the computer and the video cable

INTERACTIVE

VIDEOGRAPHICS:

EASY GRAPHIC DESIGN

ON THE C 64

Create original graphics on your Commodore 64 using a digitizing camera and a lightpen.

BY TOM BENFORD

from the camera, recorder or disc player is inserted into the module. Turn the computer on, make sure the video source is turned on, put the system's disk in the drive and boot it up.

The next thing to do is adjust the sync of the video signal by selecting this option from the menu. This is a necessary adjustment, since there is considerable variance in NTSC "standard" video signals. Sync adjustment is easily accomplished by following the on-screen directions. The sync knob is turned either to the left or the right, as indicated on the screen, until the "in sync" message appears.

Then you adjust the brightness, also by selecting from the menu. The system will perform a scan every six seconds and you may adjust the brightness control during these scans until an acceptable image is displayed. That's all there is to setting up the system.

Before we get into acquiring the actual video images, let me interject this thought. I *love* menu-driven programs, provided that their selections are complete *and* easy to understand. Digital Vision has done a superb job with their menu and they've even included a help option that concisely explains each menu selection. Here's what the menu includes:

Help View Current Image

Adjust Sync
Brightness

Normal Capture
Four-Level Capture
Eight-Level

"Catalog" provides you with a directory of the disk's contents, another handy feature to have on board a program. Normal capture allows you to acquire a high-contrast image and takes about six seconds. Four-level capture introduces shades of gray into the image by performing four scans; it takes about 25 seconds to perform a four-level capture. An eight-level capture is the result of eight individual scans taking about 50 seconds total. An eight-level image is the highest quality, with varying gray values. The results of an eight-level capture are comparable to the computer images obtained at "computer portrait" booths in amusement parks. Which capture level you choose is largely a matter of your choice as is what kind of subject you wish to digitize; the results are great with all levels.

Flexidraw

Inkwell Systems has the absolute *creme de la creme* of lightpens and impressive software to go with it. Unlike other pens that simply contain a diode connected to a couple of wires

Save to Disk
Load from
Disk
Catalog
Exit
Capture

enclosed in a hollow barrel, the Flexidraw lightpen has a mini circuit board contained inside the barrel. This circuitry enables the pen to operate in real time. (Most lightpens have a slight amount of lag in response time between your movements and the resulting screen image.) The Flexidraw pen keeps up with your hand and it is extremely sensitive—definitely the most sensitive lightpen I've ever used. The lightpen connects to control port #1 on the 64 and the software (or penware, as it is called) is supplied on disk. After booting the disk, the main title page asks you to select a program from the following choices:

Flexidraw
Pen Palette
Transgraph
Sprite Editor
Sprite Animator
Display Picture
Follow me!

Menu choices are selected by touching the lightpen to the screen next to the appropriate program, which then loads itself automatically.

Flexidraw is the drawing utility program itself. Several features—including the ability to flip, invert, rotate and shade your creations—make this the best lightpen graphics program I've seen to date. Additionally, *two* separate screens, or "pages," are



provided so that you may hold two images in memory simultaneously. You can also split the screens or combine them to create large works of art. Flexidraw supports virtually every popular dot-matrix printer and printer interface.

The Pen Palette program allows you to add color to your drawings and is most impressive. You can combine colors on 23 palettes and incorporate them into your drawing or sketch. Provisions have also been included for saving your works with or without color to disk, retrieval of your creations and a disk directory, in addition to color-printer options. Pen Palette will print out your work on several color printers, including the Okimate 10 and Diablo Inkjet.

Transgraph is a picture transmission system that allows you to send "packed" or "unpacked" pictures, receive picture files over your modem and format new disks. "Packed" pictures are digitized in a highly compacted format; they take up less space on the disk and they transmit much faster than the "unpacked" variety. However, there is a price to be paid for this code economy. Packed pictures are very susceptible to "noise" on phone lines. For most applications, the "unpacked" transmission mode, while taking a bit longer, is the safest way to go.

Sprite Editor is, as the name implies, a sprite creation utility. Using the Flex-

idraw lightpen, you select or de-select boxes within a grid that will comprise your sprite. These creations may be filed on disk for incorporating into your work at a later time, or they may be animated using Sprite Animator.

Sprite Animator allows you to link your sprite files together to create an animated sequence. Additionally, sprite data may be listed to the printer for reference or analysis.

Display Picture allows you to view your completed works in their entirety without the palette or drawing icon menu on the screen. You may also dump the image to your line printer using this option.

Follow Me! is a bonus extra that's included on the *Flexidraw* disk. It's a variation of *Simon*, the popular electronic sequence matching game. In this version, you watch the random patterns of four colored squares, then repeat the patterns with the lightpen. As long as you continue to correctly repeat the patterns, you can continue playing. A wrong guess ends the game. Each successive round increases the complexity of the pattern, so a good memory proves helpful.

Flexidraw also allows you to load two alphabetic fonts and one symbol library font and retain them in memory. These fonts and symbols may be used within your drawing to add descriptive text or labelling. Another outstanding feature of the program is "scratchpad," which allows you to copy a portion of your work and rotate, invert or replicate it elsewhere on your workscreen.

The *Flexidraw* disk also contains several high-resolution images created with the lightpen and software, as well as a short animated sequence titled "Halloween," that demonstrates the capabilities of Sprite Editor and Sprite Animator. Another nice touch is the inclusion of several symbol libraries for schematics, architectural design, music, math and science.

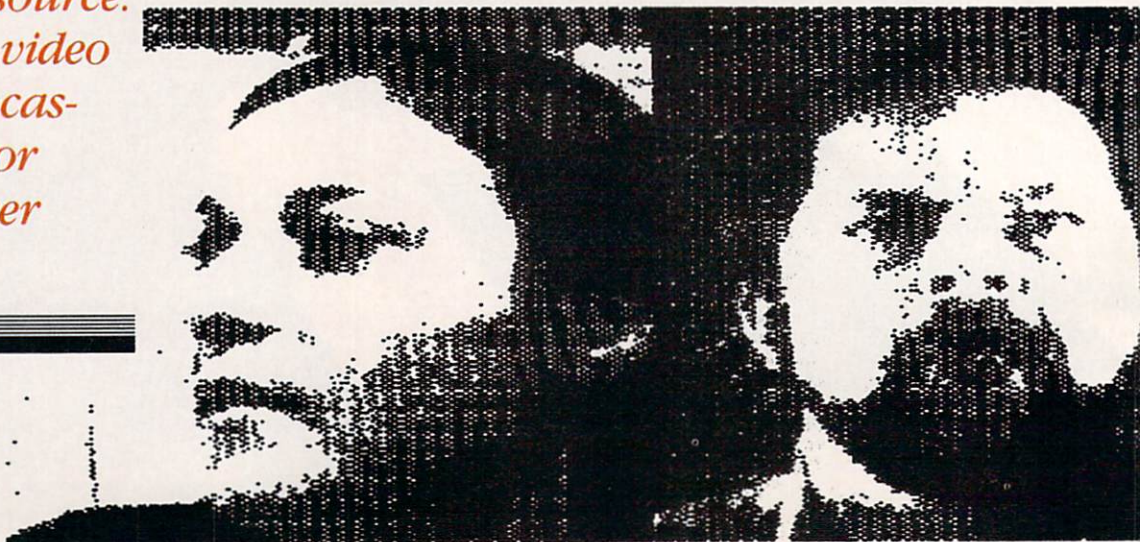
The real crowning feature, though, is the inclusion of a tutorial package on the disk, which takes you through the procedures and practices of using Pen Palette. This "short course" is interactive with the user and you "learn by doing." All factors considered, the *Flexidraw* lightpen and penware are in a class by themselves.

I used *Flexidraw* version 4.0 while researching this article and found it to be a superb hardware/software combination. Sherry Kuzara, president of Inkwell Systems, advised me that *Flexidraw* version 5.0 will incorporate several image-acquisition utilities that will work interactively with the Computereyes digitizer. *Flexidraw* version 5.0 should be available by the time you read this.

Flexifont

Inkwell Systems has also developed *Flexifont*, an interactive lightpen font-and-character-generating software package. This disk allows the user to download specific character fonts from disk, create original fonts, alter or edit them and even "capture" fonts from other sources. These fonts may be used to add text to creations com-

Computereyes allows you a great deal of flexibility for using a video source. You can use a video camera, videocassette recorder or videodisc player for input.



posed with *Flexidraw*. It should be noted that *Flexifont* is not an independent program; it must be used in conjunction with the *Flexidraw* driver software.

Several options are supported with *Flexifont*, including the ability to expand and alter the appearance of the fonts themselves. The disk includes a large selection of "Flexifonts" and normal fonts. Flexifonts are large, often ornate character sets that are ideal for headings or titles. The normal fonts are smaller and lend themselves well to adding descriptive text or labels to illustrations.

Creating Videographics

I decided the best way to illustrate the interactivity of Computereyes with *Flexidraw* was to describe, step-by-step, the actual procedures I used to create the images shown here.

I chose the Commodore logo for the first subject. I took a two-color line-art logo from a press release, mounted it on white paper and pinned it to the wall. I then set up the video camera on a tripod, connected it to the Computereyes module and adjusted the sync and brightness controls. When I got an acceptable image, I "captured" and stored the digital information on disk in "unpacked" mode. I named this file "LOGO 1."

It's important to note that I *purposefully* settled for an image that was somewhat "rough." I could have gotten a much crisper image by fine tuning the brightness control on the module and the contrast/lens controls on

the camera. My objective was to capture an acceptable image, though somewhat rough, so I could "touch it up" with the *Flexidraw* equipment.

I should also mention here that the people at Digital Vision recommend using a black-and-white video camera for best results, although I used a color video camera, and I'm entirely satisfied with the results I've obtained with it. I've also found that black-and-white subjects produce the crispest images (the Commodore logo was blue and red).

The next step was to load the *Flexidraw* penware. Once the program was loaded and the lightpen plugged in, I loaded the digital image file and proceeded to smooth out the rough spots with the lightpen. The "zoom" feature of the software really proved itself here, allowing me to enlarge portions of the screen to see the small details. In zoom mode, I selectively turned the dots on or off to smooth out the corners and other areas of the image. I also worked on the radius of the curve in the "C." This procedure took about 25 minutes. I found out that once you "get the hang" of using this sensitive lightpen you can do quick touch-ups in just a few minutes.

Next, I exited *Flexidraw* and entered Pen Palette to add some color to the image. After experimenting with several color combinations, I finally settled on my choices and I saved this image to disk, calling it "LOGO 2."

I then re-entered *Flexidraw* and inserted the *Flexifont* disk to load two fonts into the *Flexidraw* system. Us-

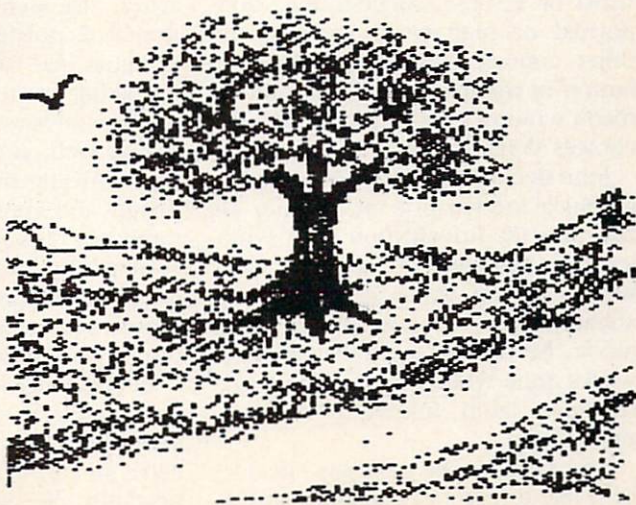
ing the font called "boldface" in expanded mode, I typed in "Commodore Computers," using the cursor controls to position the text. Next, I selected the "Type Set" font in normal mode to enter the labelling. I then loaded in the "Italics" font and proceeded to enter the credit at the bottom of the videographic. When I felt satisfied with the placement and overall look, I saved this image to disk, calling it "LOGO 3."

That's all there is to it—a completed color videographic, from start to finish, in slightly less than two hours. Of course, the image of the logo could have been created entirely with the lightpen, but since I'm not artistically inclined, using the "captured" video image was the best (and fastest) way to go on this project.

Additionally, both Computereyes and *Flexidraw* will work to some degree with other products on the market. Images captured with Computereyes or created with *Flexidraw* may be viewed by using the "get screen" function of Broderbund's *The Print Shop*. Images contained on Cardco's *Super Utility Programs* disk may be viewed with either *Flexidraw* or Computereyes as well. I've also included a variety of images captured with Computereyes as well as several of the *Flexidraw* sample images to give you a better idea of the capabilities of these products. After examining the results, I'm sure you'll agree that the *Flexidraw*/Computereyes products *do* comprise the ultimate in interactive videographics! G



Image Digitized with Computereyes
Modified/Colored with Flexidraw
Text Added with Flexifont
Videographic by Tom Benford



Videodisc players have been around for quite a few years. But until recently they have not had the success enjoyed by video cassette recorders (VCR's). What has changed that? A simple interface that lets you use a computer to control a videodisc player—specifically a Pioneer laserdisc. This control has turned the videodisc/computer into an unbeatable educational tool.

Let me give you a hypothetical situation representing what can and *is* being done *right now* thanks to the marriage of computers and videodiscs. The technology is here, it's being applied and the benefits are immeasurable to the end user.

John is a student enrolled in an art appreciation course with an assignment to do a paper about the French painter Gauguin. In the campus library's audio/visual section, he looks up an interactive laserdisc on Gauguin, gets the disk from the librarian, and sits down in one of the nooks. Before him on the countertop is a Commodore 64, a 1541 disk drive, a Pioneer laserdisc player and a color monitor. These components are tied together through an interface box, and a port on the interface has a joystick connected to it.

John inserts the laserdisc into the player, inserts a software disk into the 1541 and proceeds to boot his programs. A title screen appears on the monitor, "The Life and Works of Gauguin." A menu window at the lower portion of the monitor screen advises him that the joystick will control all scanning functions, both forward or reverse, single-frame, slow, normal or high-speed viewing and other control functions. The action button of the joystick calls additional menu windows and is used to finalize choices along the way.

John decides to start with some biographical information on Gauguin. He zips past the information on his adolescence and stops at Gauguin's early works, taking some notes. Moving ahead, again in high-speed scan mode, he pauses at the selection of works done while the painter was residing in Tahiti, known as his "savage" period.

He examines the paintings, decides he'd like to get a closer look, and directs the cursor arrow via the joystick

Now you can gain access to a new world of "live" information using your Commodore computer to control a videodisc player. The opportunities for the future have only begun to be explored.

THE INTERACTIVE VIDEODISC REVOLUTION

BY TOM BENFORD

to zoom-in on a particular area of one of the paintings. The computer/laserdisc system responds instantly, providing him with an extreme close-up view. He studies the brush strokes and palette-knife textures, takes some more notes, then resumes his scan.

John then observes that the later paintings done during this "savage" period differ radically from the earlier works. He switches back to the biographical portion and finds out that Gauguin had tried to commit suicide by taking arsenic after an episode of unrequited love. John makes notes on this as well, and continues on in this fashion using the joystick to find the images and information he feels pertinent for his course assignment. Within the next half-hour he has enough information to complete his report, so he goes back to the dorm to transcribe his notes.

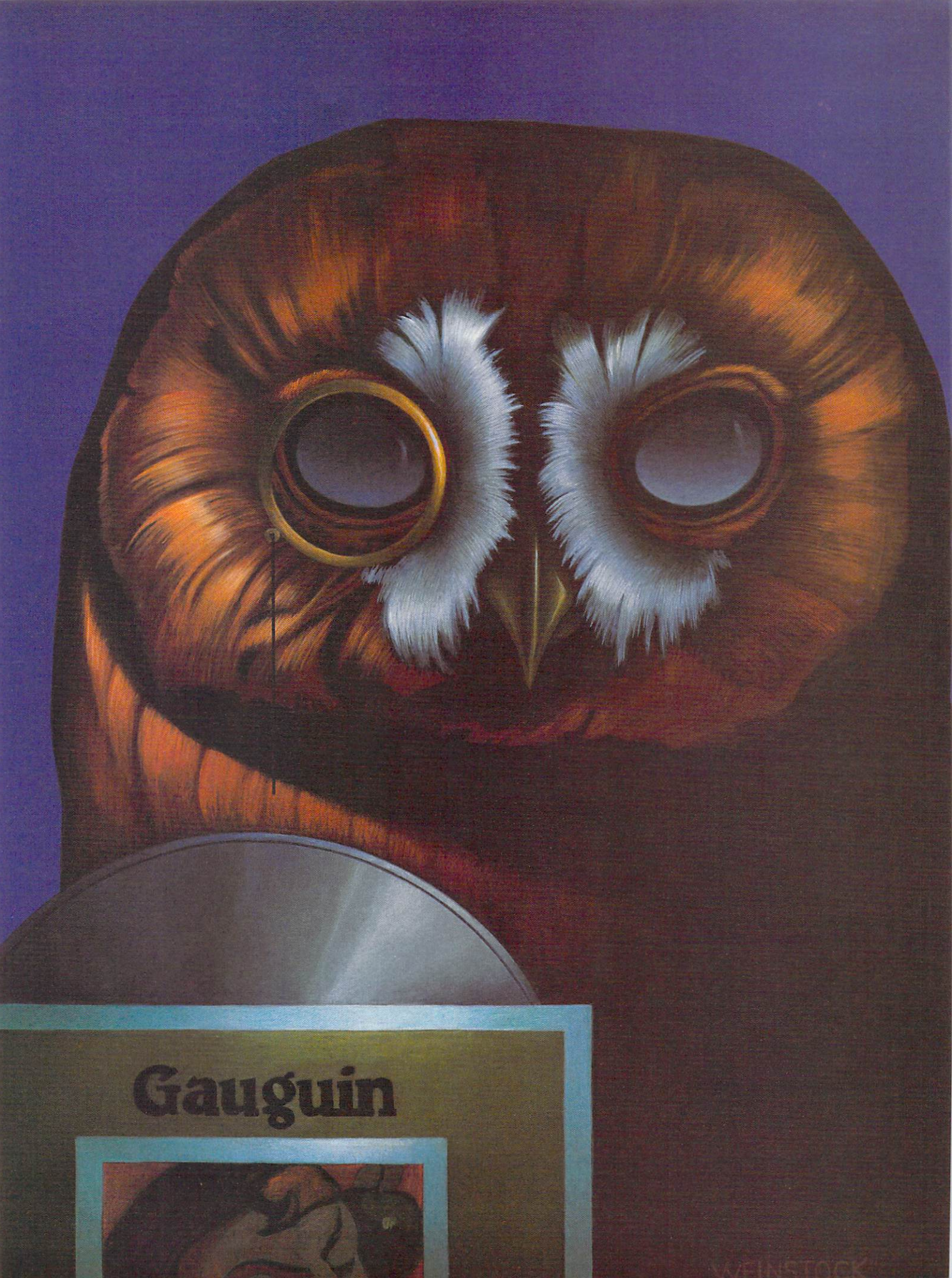
In the short space of one hour he has acquired enough information about Gauguin and his paintings to receive an "A" in the course. More importantly, he has comprehended the information and retained it, since he

was able to access it at a pace that was comfortable for him. He's also eliminated the need to read several books on Gauguin and a trip to the museum to eyeball *only one* of the paintings. From the school library he's been able to see them *all* and inspect them more closely than any museum curator would allow.

In another hypothetical example, let's say that you'd like to find out more about Rome—you've never been there, but you're considering a vacation there. From your neighborhood library (or travel agent, for that matter!) you borrow an interactive laserdisc entitled "Rome—Past and Present." From your livingroom, you get a *cinema verite* tour of the city. Your point of view is that of a person walking down a quaint cobblestone street with shops to the left and right. You decide you'd like to examine the wares of a goldsmith, and by moving your joystick to the left, you enter the shop and are greeted by the shop owner.

The possible applications are virtually limitless. As a third example, let's

Continued on page 117



Gauguin



WEINSTOCK

F

BY TIM ONOSKO

From a suite of offices and workrooms in the basement of Berkeley, California's stately and elegant Claremont Hotel, Steve Beck leads a group of engineers and designers in an enterprise called Beck-Tech, which he founded in 1978. The company's clients have ranged from toy companies (hand-held games for Coleco, Lakeside and GAF while that craze lasted) to Magaux Controls, for which Beck and company created an energy management system now used extensively by corporations including the Safeway chain of supermarkets. Along the way, Beck-Tech has developed computer-aided instruction systems for the Standard Oil Corporation and contributed special effects for the Ken Russell film *Altered States*.

Many of Beck's interests began as a boy, growing up in Illinois. Like so many of the kids of the post-war baby boom, he was fascinated by television and built play TV cameras out of wax paper tubes and shoe boxes. Years later, at the University of Illinois, he would study electrical engineering and computer science with a special interest in video.

Also during his boyhood, he discovered that he could produce scintillating colors and patterns by pressing on his eyelids while he lay in bed waiting for sleep. In the late 60's Beck would develop the first direct electronic video synthesizer in an attempt to recreate these inner visions on a TV screen. Another of his developments, an electronic device he calls the Phosphotron, can directly produce such light effects by electrically stimulating the eye's production of organic photochemicals known as phosphenes.

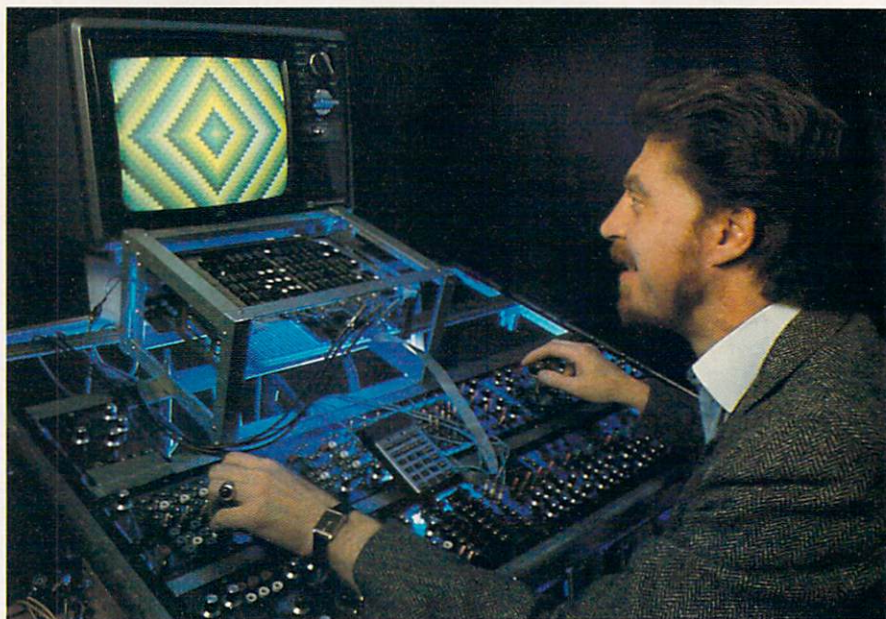
In 1970, Beck joined San Francisco's Experimental Television Center, which was funded by PBS to produce new video works for the network. While associated with the Center as an artist in residence, he gained a reputation as a pioneer of computer graphics and new images, and his work joined the collections of major international art museums. One piece, titled "Union," won a major prize in the Prix Italia television competition.

Among Beck's video work is a series of Video Weavings—experimental works that express his interest in traditional hand loom weaving—

STEVE BECK:

Renaissance Man of the Future

*Stephen Beck is involved with personal computers, machine control by microprocessors, electronic visual art, commercial software and human perception. He's created special effects for the film *Altered States* and is the inventor of a visual device called the Phosphotron.*



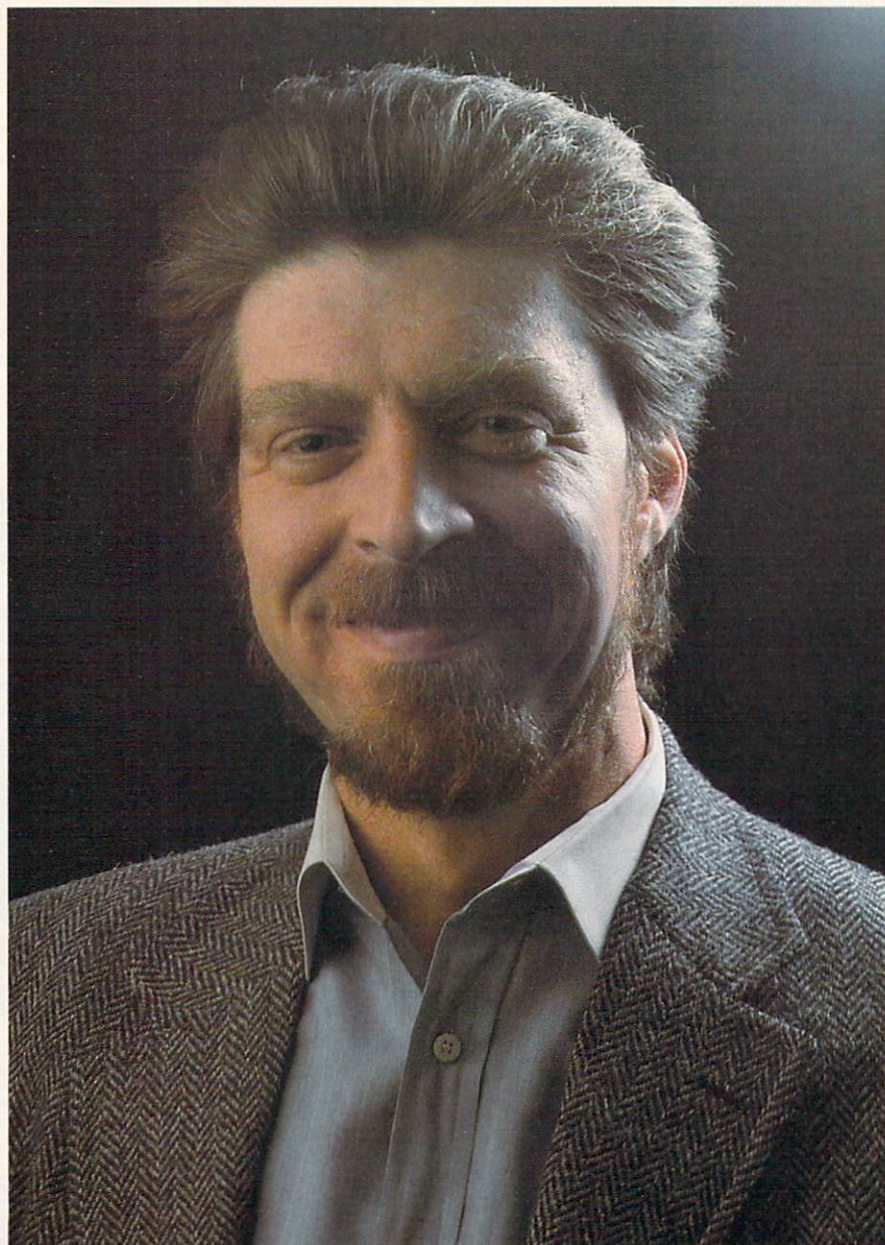
Beck at his Video Weaving console. He has also created Video Weaving software on cartridge for the Commodore 64 that allows users to create these colorful tapestries.

based on the programming of warps and wefts. Many of his video pieces have recently been assembled into a series of videocassettes called *Illuminated Music*, now being sold to the home video market.

It is no surprise that Beck is intensely interested in the future and the possibilities for new applications of electronics and computer technology, although many of his ideas and

developments remain waiting for new generations of hardware and refinements of software techniques. Meanwhile, his shop is busily creating commercial work.

Although they joined the video game business somewhat late, Beck-Tech's line of Commodore 64 programs for Sega are among the best arcade game conversions for home machines. The group's disk versions



of *Congo Bongo* and *Tapper*, for instance, feature excellent cartoon-style animation. *Breakdance*, another Beck-Tech game published by Epyx (for whom the group has also designed *Nine-to-Five Typing*) is highlighted by a creative free-form "video choreography" mode.

Beck thinks the Commodore 64 fills the need for a relatively inexpensive and yet powerful appliance-type computer. And the mammoth installed base of these machines has created the first true mass market for sophisticated software. Though Beck-Tech has had success selling games to this market, Beck is thinking and planning other kinds of creative products.

All of Beck-Tech's developments for personal computers only serve to stimulate Beck's ideas for the future of home computing, although he thinks that the computer industry must continue to work hard to show people why they need a machine.

"I think the industry in general has to demonstrate to the public at large that there is more that can be done with a personal computer than play games, process words and run spreadsheets," he says. "Those applications have sold to a certain share of the market, but things have reached a plateau. I think it's important that developers like us come out of the gate with more meaningful, more significant products so that people can

understand how computers can help them in their daily life in more ways than playing games and being entertained."

One of these ways, Beck feels, is in showing how a computer can be useful in controlling home environments.

"We've developed a product that can be used with a personal computer in the home to apply many of the technologies we've developed for commercial and industrial energy management. With it, you might achieve a ten to twenty percent reduc-

"I think it's important that developers like us come out of the gate with more meaningful, more significant products."

tion in the cost of electrical energy to heat and cool your home. If you live in a part of the country where it's not unusual to spend \$300 to \$400 every month to heat or cool your home you might save ten percent or about \$40 per month for five months. That's a couple hundred dollars every year, which should more than justify buying a peripheral and control modules to implement such a system."

"It's not just black-box magic," he emphasizes. "There are real things that can be done in the home—things like time scheduling, duty cycling, demand control, adaptive control—that can easily produce real savings."

Another area that Beck feels is worth investigating is the use of personal computers in health care and medicine.

"Obviously the costs of medical care and treatment are skyrocketing

and it's a major problem facing our society," he says thoughtfully. "To the extent that a computer can memorize large amounts of data and build up a health trend profile, I see products that deal in limited ways with interfacing a person to a computer. I think a computer that can develop a day-to-day medical profile of an individual on a floppy disk can be useful in both treatment and diagnosis by a doctor who has access to that disk. In other words, when you go into the doctor's office, you go in with that disk. The doctor can have much better information about who you are and what you do and how your vital signs vary from day to day."

To facilitate this, Beck envisions health peripherals to use with personal computers and, eventually, the development of monitors that could

"I think a computer that can develop a day-to-day medical profile of an individual on a floppy disk can be useful in both treatment and diagnosis by a doctor who has access to that disk."

be worn all day by outpatients and post-operative patients, connected to a pocket-sized computer. Doctors could then call the portable units using a telephone and modem to access the data. "It's within the scope of the technology to assume that this can and will happen," he says.

One obvious application of personal computers would be to provide a preliminary diagnosis, before an individual consults a doctor. "The classic program, *Eliza*," says Beck, "indicates how, even without capabilities for real artificial intelligence, you can have a pseudo-scientific dialog with someone and acquire certain information." *Eliza*, created in the 1960's, was originally designed to simulate a conversation with a psychoanalyst, but had no diagnostic power itself.

Also on his list of diagnostic tools are computer peripherals that could take your temperature, analyze your

blood chemistry or perform urinalysis through some simple sensing apparatus. One use for such a device would be the electronic equivalent of the early pregnancy test kits now being sold by pharmaceutical houses.

"We're actually developing a related product right now," Beck adds. "We call it Electronic Computerized Birth Control and it will allow a couple to determine fertility cycles in a woman to either achieve or avoid pregnancy."

Naturally, Beck is as interested in the world of communications as any

of his engineering colleagues, and feels that the popularity of modems for home computers only begins to hint at the terrific opportunities.

"Some of the new technologies of transmitting data over FM radio subcarriers," he reminds us, "literally mean that you'll be able to pluck information and software out of thin air."

For electronic publishing, he has yet another idea. "A pet idea of mine that I've been wanting to implement for many years is an electronic version of *TV Guide*. This way, instead of flip-

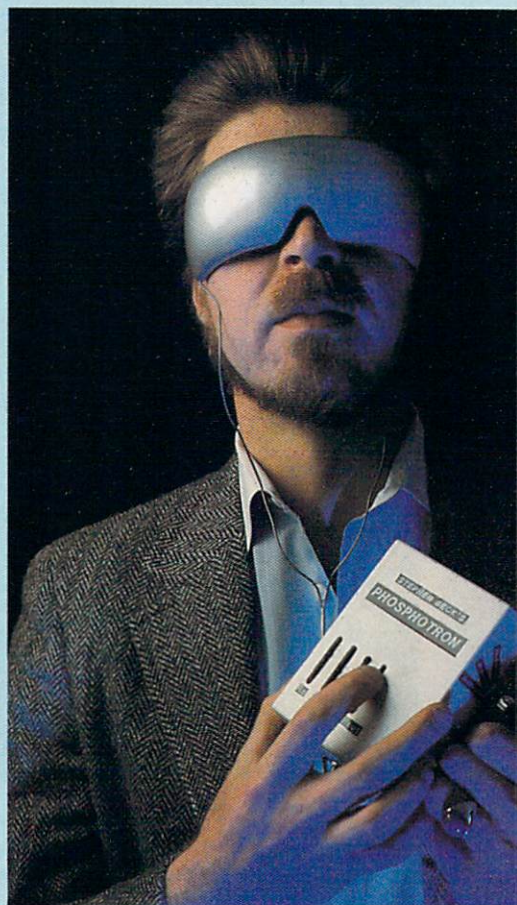
Phosphotron Lets You "See" with Your Eyes Closed

Maybe one of the most unusual, yet promising, scientific developments to come from Beck-Tech is the Phosphotron, a device that electronically creates the illusion of light inside the human eye. Even in its present, primitive form, it demonstrates enormous potential.

The Phosphotron—the name is a combination of the Greek words for light and electricity—works by stimulating the production of naturally occurring photochemicals in the eye, called *phosphenes*. You can see the effects of phosphenes if you rub your eyes in the dark. The patterns of light and color that you perceive are actually due to phosphene production. Phosphenes are also mechanically stimulated when someone is struck sharply on the head and claims to "see stars."

There is some dispute in medical circles as to exactly where in the eye phosphenes are actually produced and what part of the eye/brain system they actually affect. But the existence and effects of phosphenes have been known by physiologists and neurologists for a very long time.

Steve Beck, as a boy, was fascinated by the effects of phosphenes, long before he knew what they were. In college, at the University of Illinois, Beck came across an article in *Scientific America* about German research into phosphenes, which at long last explained the phenomenon he was already familiar with. The Germans, it seems, applied minute, modulated electrical currents to the face, in the region of the eyes. In short time, Beck had fashioned his own electronic device for phosphene experimentation—some electronic circuitry and a pair of electrodes—a prototype of today's Phosphotron.



Steve Beck demonstrates his Phosphotron, which stimulates the eyes electronically to create the illusion of light.

ping through the pages of the magazine, you simply call it up on your home screen. Then when you see a program you want to watch, you could just push a button and it would automatically enter into the programming memory of your home VCR. So time-shifting would become a much more straightforward matter. Or let's say you enter a certain set of interests into your computer and it scans your digital *TV Guide* to find programs that match those interests. It could give you a printout or menu or even program the TV to come on that those

times and on the correct channel.

"All of these communications options, of course," he cautions, "lead us deeper and deeper into a situation where a 'big brother' could exist. So I think we should want to step back and take a socio-political stance and say 'this is all neat stuff, and it appears to be great, but there are all sorts of other implications here.'"

Beck also points out that because the present generation of personal computers can do only one thing at a time, many of his ideas will have to wait for the next machines. For now,

controlling the energy consumption in your home or using the computer for health care or communications means that your computer is tied up doing just that one task. Will the next generation of machines, which includes Commodore's forthcoming Amiga "supermicro," be enough to handle several jobs simultaneously?

"The indications are that they should," he thinks. "The next problem that the industry has to address is multitasking and concurrency. Certainly going to machines with faster CPU's and more memory suggests that the possibility is there in the hardware. Now whether the software is

"That was about 1968," recalls Beck. "I had a simple battery-operated circuit and a waveform generator. It was powered by a couple of D cells. I had to take precautions, because anytime you introduce currents into the body you must be very, very careful. It was clear that by confining the currents up in the eye area I wouldn't run the risk of cardio-pulmonary arrest, which you would get with the current running through the heart. Don't forget, the nerve signals in the body are very, very weak signals—millivolt and milliamp—so a battery at 1.5 volts with a 100 milliamp-hour capability applied in the right place can probably harm you and stop your heart," he cautions and urges that no one try to recreate his experiments without close supervision.

"At that time, I was working with television and my video synthesizer on non-objective imagery," he says. "At the same time, since the idea of using video and synthesizers was tangible and available to almost anyone, the next thought was: Why not eliminate the screen entirely?"

The German researchers had been using rectangular pulses, but Beck was using other waveforms. He could create pulses, ramps, and triangular waves, and by running the triangles through a filter, he could do a kind of parabolic, sine wave-type of signal. The modulated currents (in the microramp range) are then applied to the area around the eyes by contact electrodes. The result was that Beck could produce a variety of abstract light effects that could be seen with the eyes closed.

Present models of the Phosphotron consist of a small box which contains the electronic circuits (mainly CMOS ICs), the necessary controls for varying the effect, and an input so that the box can be controlled by sound (for doing phosphene demonstrations in time to music). There is also a pair of light-tight silver goggles with built-in electrodes that fit on each side of the head, directly behind and slightly above the eyes and below and in front of the temples. Up to a dozen pairs of these goggles can be wired to the box, in series, for multiple viewing.

So what do you see when Beck turns his Phosphotron on? Mainly patterns of white light that seem to emanate from the corners of the eyes, the regions closest to where the electrodes contact the skin. By adjusting the device, however, Beck can produce directional effects—a rippling wave, a pulsating spot—and many subjects have reported the perception of colors, once adapted to the dark. Beck is also at work on refining the electrodes and hopes to next experiment with an array of electrodes, each computer-controlled to produce distinct shapes and, eventually, completely formed characters. The blue-sky future offers the possibility of full video—television without a screen. But Beck stresses that the device is presently in the "dot-and-dash" stage.

Following early press reports about the Phosphotron, Beck has been plagued by requests to sell the device, and he is considering marketing a model that will be controlled by an inexpensive personal computer. The questions of product liabilities, he says, are—as one would expect—quite elaborate and may be difficult to settle.

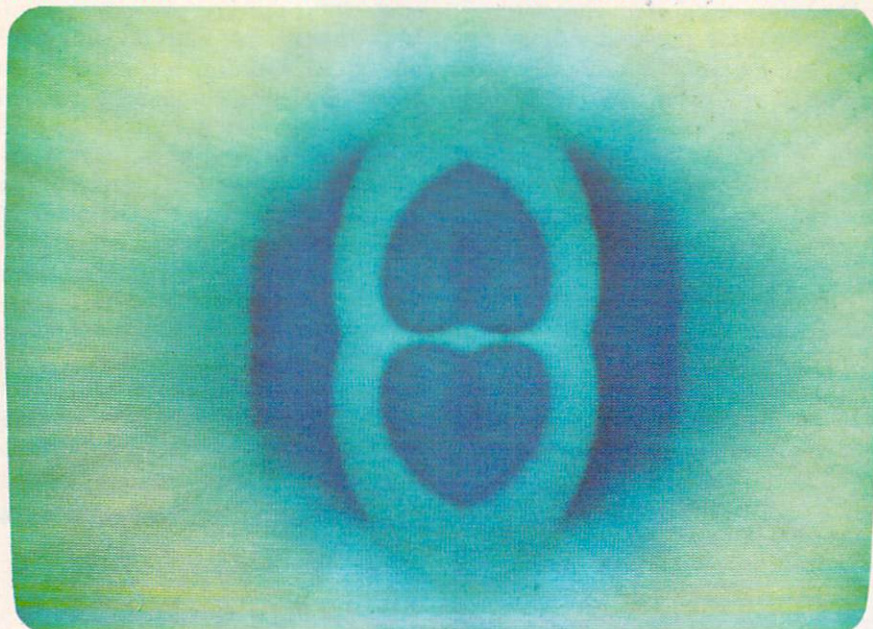
One of Beck's hopes for the future is that computers may one day help people become more creative, just as they've made them more productive.

up to snuff is another matter. I don't think you need a VAX (a minicomputer with the capabilities of a small mainframe), but I think you just need the architecture of the machine to be designed to recognize that multitasking and concurrency are very important issues moving into the next generation. You don't necessarily need the power of a VAX, but you need the architecture."

A new class of smart peripherals is also necessary to achieve all of Beck's goals. He thinks designers must realize that you can't do everything with one CPU. Peripherals for home control will have to handle high-level functions in their own right, thus keeping the computer's CPU from having to do every little detail of every little task.

"I see this happening with the development of co-processors like numeric or text co-processors or I/O co-processors. Or give me two or three eight-bit microprocessors in the same package and I can probably exceed the power of a single 16-bit machine." He also notes that if today's inexpensive eight-bit personal computers become cheap enough, you could dedi-

Continued next page



Steve Beck's computer image titled "Union" won a major prize in the Prix Italia television competition.

cate as many as you wanted to tasks like energy management and security.

One of Beck's hopes for the future is that computers may one day help people become more *creative*, just as they've made them more productive.

"There's the old story that you can sit a monkey down at a typewriter and eventually it will type something of significance," he jokes. "And obviously writing is one creative activity suitable to personal computers. But, I think one application that could be good for writers, pending an advance in artificial intelligence techniques, is a case where the computer could assist you in the creative process itself.

"When we create something, we kind of haul it around with us and then we might store it in the subconscious or the unconscious. Later, things come back, from time to time. If there were some way we could better understand this process and, perhaps, have a dialog with the computer to assist the process itself, then we could apply it on many different levels—to the visual as well as the literal, written word."

Graphics programs have become the equivalent of word processors to visual artists. Does Beck think we will come to a time when people are painting pictures on a computer instead of canvas?

"I think we're already there," he says with enthusiasm. But he thinks that the general public needs to adapt to the concept of electronic art. "When we get a flat-screen, wall-

"When we get a flat-screen, wall-mounted TV, then I hope people will have less trouble making the conceptual jump between classical and computer art."

mounted TV, then I hope people will have less trouble making the conceptual jump between classical and computer art. Then the distinction between the technology and the content will vanish, and people will once again be involved with the meaning and significance of the message rather than the technology used to display the image."

An aesthetic endeavor that Beck feels close to is the process of weaving, as typified by his Video Weaving experimental pieces. He has already adapted the idea to the Commodore 64. The product is cartridge-based software that allows the user to create colorful, tapestry-like designs and then animate them. The movements are not random, however, but are controlled via a simple interface between a home stereo system and the Commodore 64's joystick ports. And, in the same vein, Beck is working on a computer interface with a Chico, Cali-

fornia, manufacturer of looms.

"Well, it's an interesting niche," he says of his personal efforts to computerize the weaving industry. "There are certain fundamental and historical connections between the technology of weaving and the technology of computers—specifically the Jacquard loom and the use of punch cards. In spite of what people may think, much of the work in this area has been quite primitive. You can design the patterns on the screen but the loom still has to be programmed manually."

And, of course, there's an established textile industry—one of the oldest industries in the U.S.—which is not particularly interested in changing. Ironically, it knows it must automate to stay competitive in the world market, but is unwilling to make the investment, claims Beck.

"On the home and personal level," says Beck, "it's a different—but similar—situation. There's a resistance on the part of many weavers. They like the idea that they are very low-tech. Only a few welcome the idea of taking the burden out of programming the warps and wefts and shuttles by hand."

Of course, all talk of the future of personal computers must acknowledge the *big* question: Is there a future for personal computers at all? Will they fade—a passing fad like the video game? Or will they last and become part of the popular culture?

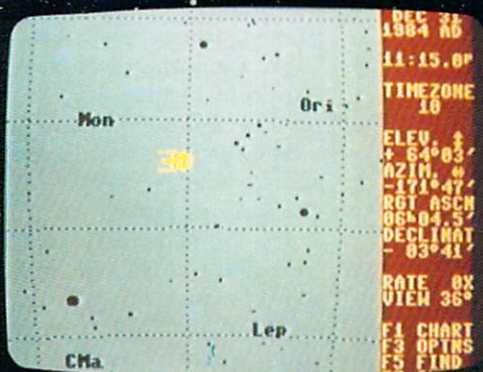
"Oh, I think they will definitely last," says Beck, without hesitation. "What we have now are Model T's. And I think they will follow the same progression as the automobile industry. After all, the computer is the mental equivalent of the automobile. It allows you to travel to all these different places on a mental and intellectual level, just like the automobile lets us travel on a physical level. Looking at today's children, they've never lived in a time when there weren't personal computers, just like other generations never knew a time without automobiles. And just like the car industry introduces new models with more power or new features, new computers will offer new improved models and better cost performance.

"The industry will respond to the issues and needs and mature into more meaningful and useful applications. But it's going to take lots of hit-and-miss and experimentation." **C**

SKY TRAVEL

A WINDOW TO OUR GALAXY

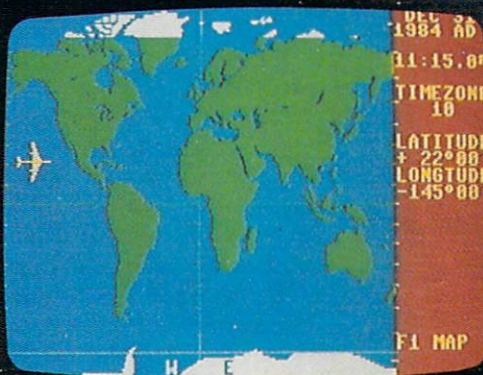
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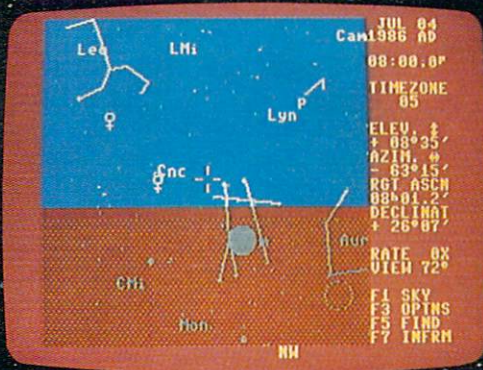
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Télétel: Telecommunications for the Non-Computerist



DENISE BONEAU

While most people watch America and Japan for the newest computer trends, a significant revolution is occurring elsewhere. It is a new French Revolution called Télétel—"un nouveau moyen de communication" (a new means of communication), according to a publicity flyer from the PTT (Postes, Telecommunications et Telediffusion), France's national communications agency.

The Télétel revolution is not so much a technological advance as a great leap forward socially—a leap in the use of technology. The system, developed by the PTT, could revolutionize computer use and change an entire nation's attitude toward computers, for Télétel is an effort by the French to put interactive computers into every corner of their nation.

Those computers are called minitels, 10" x 9-3/4" x 8" modem units manufactured by Telic for the PTT. Telephone users simply plug their regular phones (rotary or digital) into the back of the minitel, plug in the unit's electric cord, then plug it directly into the country's telephone system. The *clavier* (keyboard) folds

France's innovative telecommunications system is becoming a common household item, allowing access to banking, phone and postal information, shopping services and local information bulletin boards—all with a simple device called "minitel."

down in front, exposing a nine-inch black-and-white monitor. The design is crisp, simple and unimposing.

Customers turn on their minitel, dial the access number on their phone, wait for the proper tone, tap an access code if necessary, tap the *Connexion* key and hang up their phone. Télétel service has been

accessed.

The primary incentive behind the PTT's initiative is the recent dramatic rise in telephone use in France—five-fold between 1970 and 1983—and the accompanying burden placed on printed *annuaires* (directories). In 1982, a full-time staff of 600 was employed in turning 38,000 tons of paper into 23 million phone books providing 18,980,000 listings. In the same year, 5,380,000 listings changed. In France, as in the United States, printed directories are inefficient and obsolete, as is the cumbersome practice of "calling the operator." With Télétel's *annuaire électronique*, each person can be his or her own directory operator. The need for professional operators is minimized, and, if the PTT's plan is realized, printed directories may be banished entirely to the past by the early 1990's.

Type in the name PROUST, city PARIS, first name MARCEL, enter it, and a name, phone number and address in the 12th arrondissement appears. Want every establishment in Paris with "American" in it? Type AMERICAN and PARIS, enter it and 90 listings are called up. Or every movie theater on the Champs Elysees? It provides 20. Or perhaps you need the number of the marvelous patisserie on the rue de Paris in Boulogne-Billancourt, but you don't know its name or exact street number. Type PATISSERIE, BOULOGNE-BILLANCOURT and RUE DE PARIS and moments later a single complete entry appears.

The minitel is an extremely user friendly computer—so much so that Gérard Plet, head of minitel distribution in the *région* of Picardie, north of Paris—where Télétel first appeared publicly—classes the minitel as a different sort of equipment: "One of our first missions was to dissipate fears. Some people thought that the minitel was a computer or that one must be well versed in computer knowledge to work with it." There are no computer languages to learn, nor even operation codes. No computer training or facility is required to use it. Most services use menu systems that lead users step by step toward the desired information.

TELECOMMUNICATIONS

The laws permitting the development of Télétel were passed in 1970 (further laws governing what services Télétel may offer were passed between then and late 1982). In November, 1980, a study commission convened, and on July 9, 1981, PTT minister Louis Mexandeau officially inaugurated the "Télétel 3V" study in three areas near Paris—Vélizy, Versailles and the Val de Bièvre. Through the end of 1982, 2,500 volunteer families used a prototype Télétel system offering 190 services, ranging from a media service, banking, and transportation information, to message centers, energy counseling and school studies.

February 1983 was the watershed date for Télétel, when Ile-et-Vilaine, a *department* in the *région* of Bretagne (Brittany) opened its public electronic directory and general Télétel service. With it came the distribution of minitels to telephone customers. Within a year, directories were completed for three *régions*—Bretagne, Picardie, and Ile-de-France (in which Paris is located). By November, 1984, six of France's 22 *régions* had Télétel electronic directories. The Télétel revolution had truly begun!

The distribution of minitels to consumers is a more gradual process, resulting from manufacturing limits and PTT bureaucracy. In June, 1984, the PTT had given out about 200,000 minitels; at the end of the year, 600,000 minitels—still a small number in a nation of 55 million people. The momentum is increasing, however. The PTT projects it will distribute three million by the end of 1986 and service will be established in every *région* by 1987. In the meantime, minitels restricted to directory use can be used free of charge in every post office in *régions* with Télétel directories.

What makes this project even more impressive is that the basic minitel costs nothing to customers invited to get a unit, except the forfeiture of the annual printed directory and the time needed to pick it up at a *téléboutique* and get an introductory demonstration. Those wishing the more advanced "minitel 10" model, with a built-in phone and 20-phone-number memory, pay 50 francs (\$5.50) extra per month. Customers outside the



DENISE BONEAU



DENISE BONEAU

present distribution areas may get the equipment for an additional 70 francs per month.

The PTT, although the guiding force behind Télétel, is not the only minitel source, however. Many banks, in particular, as inducement for customers, offer free minitels for opening an account—a far more attractive inducement than American banks' offers of toaster ovens and clock radios. For people not yet offered free minitels by the PTT or unwilling to pay the fee, these bank premiums provide another way to enter the world of

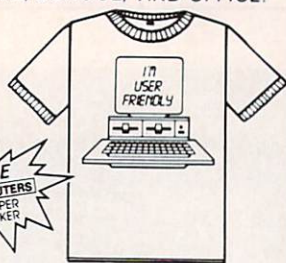
Télétel. Along with being able to access the bank's service using the minitel, customers have potential access to all other services.

Also, current owners of many brands of personal computers, starting in late 1984 and early 1985, can buy the interface hardware and software that permit them to use Télétel.

Were the Télétel system only used as a telephone directory service, it would likely be valuable enough. But even the basic service provided by the PTT goes beyond that, providing guidance in making calls (both domestic and foreign), phone rates, postal codes and rates and a minitel usage guide. Beyond that, by the end of 1984 there were more than 500 Télétel services, with new ones appearing almost daily: numerous banks, including France's three largest; a Télétel-delivered school (presently rated as not up to its potential); consumer services; TV stations, newspapers, and magazines, including an abstract service for numerous publications and an electronic version of the indispensable *Pariscope*, the weekly guide to Paris cultural events; a shoppers' catalog and buying service; municipal information services and bulletin boards provided by cities; message centers; and even a pari-mutuel guide (no betting—just results and calendars). And, of course, there is a *Télétel Guide and Magazine*.

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TELECOMMUNICATIONS

Many banks offer free minitels for opening an account.

Many services are free beyond the cost of the phone call; others require subscriptions or accounts.

The year 1984 also brought the Télétel revolution to the National Assembly, where PTT minister Mexandeau inaugurated a system in which orders of the day, proposed legislation, nominations and reports became available via minitels in each of the 105 deputies' offices. Voting by minitel has not yet been instituted.

To American computer owners who use a modem to access computer services, to anyone familiar with the possibilities afforded by computers, Télétel may not seem unusually impressive. Compared with most home computer set-ups, the minitel is designed simply and operates slowly. It is saddled with keys requiring firm pressure, has no disk drive, and its applications presently are wide-ranging but unsurprising.

However, it is not its depth that is striking but its potential breadth of scope and availability. Télétel isn't merely for those who have taken their own initiative first to buy a personal computer then invest in a modem. It's for everyone who owns a telephone. Within a decade most French citizens will have swift, easy access to a vast treasure of basic, everyday information and services.

For the future, a peripheral jack is built into the back of the minitel to link it up with printers, other personal computers, etc. Today's minitels are first- and second-generation units. The minitel 1, the only model available in February, 1983, has been developed and improved. Already there is the minitel 10 and color minitels are being made. In years to come, French

consumers will surely have a greater selection of minitel models of increasing capability, facility and practicality.

What does this French development suggest for America? Is the Télétel system viable in the United States? Technologically, the United States is fully able to reproduce the French system, even though its telephone network is many times larger than France's. The French, in fact, tend to criticize themselves for being technological followers, not leaders, trailing America and Japan. What they lack in technological superiority, however, they make up for in enthusiastic, imaginative applications that stand at the avant-garde. The Télétel is an excellent example.

But if a system like France's Télétel is to be realized in the United States, its future may depend more on political and economic structures than technology. The French system has been greatly aided, if not made possible, by the French phone system's being nationalized. This permits a well channelled, standardized effort from the start. The recent trend toward deregulation and anti-trust coupled with an American free-enterprise system in which several different systems compete for pre-eminence (as with video cassette systems) make the climate questionable for smooth, swift implementation of a Télétel-like system.

The technological success of the PTT project is nearly unanimously praised, even with its initial bugs (access phone lines that fill too quickly; the time needed to get any information, which almost always goes well beyond the basic two-minute billing period, causing phone bills to mount swiftly). At the same time, some people express doubt and concern. "The directory service is free now and owning a minitel is free and voluntary," a French friend notes. "But the PTT is a monopoly, after all. What happens in a few years, when there are no longer any printed directories and everyone must have a minitel and use the electronic directory? Will we have to pay to have minitels, and will it suddenly cost 75 centimes or a franc every time one calls the directory?" These are real concerns that must be addressed if any system like Télétel is to be truly workable and widely accepted.

Sky Travel

Challenge: Part 3

In the last issue of *Commodore Microcomputers*, we posed a challenge to users of *Sky Travel*, Commodore's astronomy program for the Commodore 64. The authors of the program have placed 11 different undocumented "tokens" within the software. If you can figure out, first, what it is you're looking for, and second, each of the 11 different sets of coordinates, and you then place yourself there during the right time period and look in the right direction, you will see each of the 11 different items. For instance, if you figure out that the Washington Monument is one of the tokens, you would put yourself at the coordinates for Washington, D.C. after the year 1884 in order to see it on your screen. (Sorry, that's not one of them, but you get the idea.)

We began in our last issue with a set of extremely difficult clues, then offered an easier set in the April/May *Commodore Power/Play*. Here we include both of those sets of clues plus the final—and easiest—set. If you still can't figure them out, look on page 120 for the answers.

CLUES

1. An alert person should have no trouble finding the bear.
 - 1a. The "Alert" person likely resides in an igloo.
 - 1b. Bear looks due east, sees green land.
2. Stated empirically, if the bear really exists, he gets top billing.
 - 2a. When bear reaches top billing, he detects the odor of gorilla.
 - 2b. The bear also loves large apples.
3. See an angry bear, not one but two, on tour, climb high, higher, highest with no visible means of support.
 - 3a. Away it gives "two on tour."
 - 3b. Not far away is Niagara Falls.
4. Hungry bear, but a half-wit, looks for hamburgers, is disappointed, but we're not, are we?
 - 4a. The bear sees half of a familiar looking landmark in the distance.
 - 4b. Think of a billion hamburgers.
5. Guilty bear is fugitive, is chased by Canadian police force.
 - 5a. The bear may be in Canada, but the "Mountie" is not.
 - 5b. I'm sorry, "fugitive" should have been spelled "fujitive."
6. How do you expect to find the bear if you are looking for a mosque?
 - 6a. Look for a mosque—how would you do that?
 - 6b. Nyet, nyet—stop looking for a mosque.
7. Don't cross this one off, because, although suspenseful, you have to wait until the bear comes to it.
 - 7a. Bear finds gold by figuring out what it is that he

- shouldn't cross before coming to it.
- 7b. Bear left his heart there.
8. Betsy says, "Jim, go in and get my pen, and don't worry about the bear."
- 8a. Betsy is THE Betsy. Her husband has been knighted.
- 8b. Not a nice place to visit (nothing to see but white), nor would you want to live there (too cold).
9. Bear goes 200 steps north, 200 steps east, 200 steps south, and 200 steps west. What color is the bear?
- 9a. Bear would be better off if he were a camel.
- 9b. Tell bear "turn right, peer amid the wall, look for an opening."
10. Bear has party, gets plastered in style.
 - 10a. Plaster is dehydrated calcium sulfate.
 - 10b. I fell off this tower once.
11. The bear may be gentle, but he's still pretty big, so watch out!
 - 11a. Green witch casts spell on bear by saying bong, bong!
 - 11b. Bear can't see what time it is, too foggy here.

While you tear your hair out trying to solve these, we hope that you will learn some geography and astronomy. Good luck!

Answers on pg. 120



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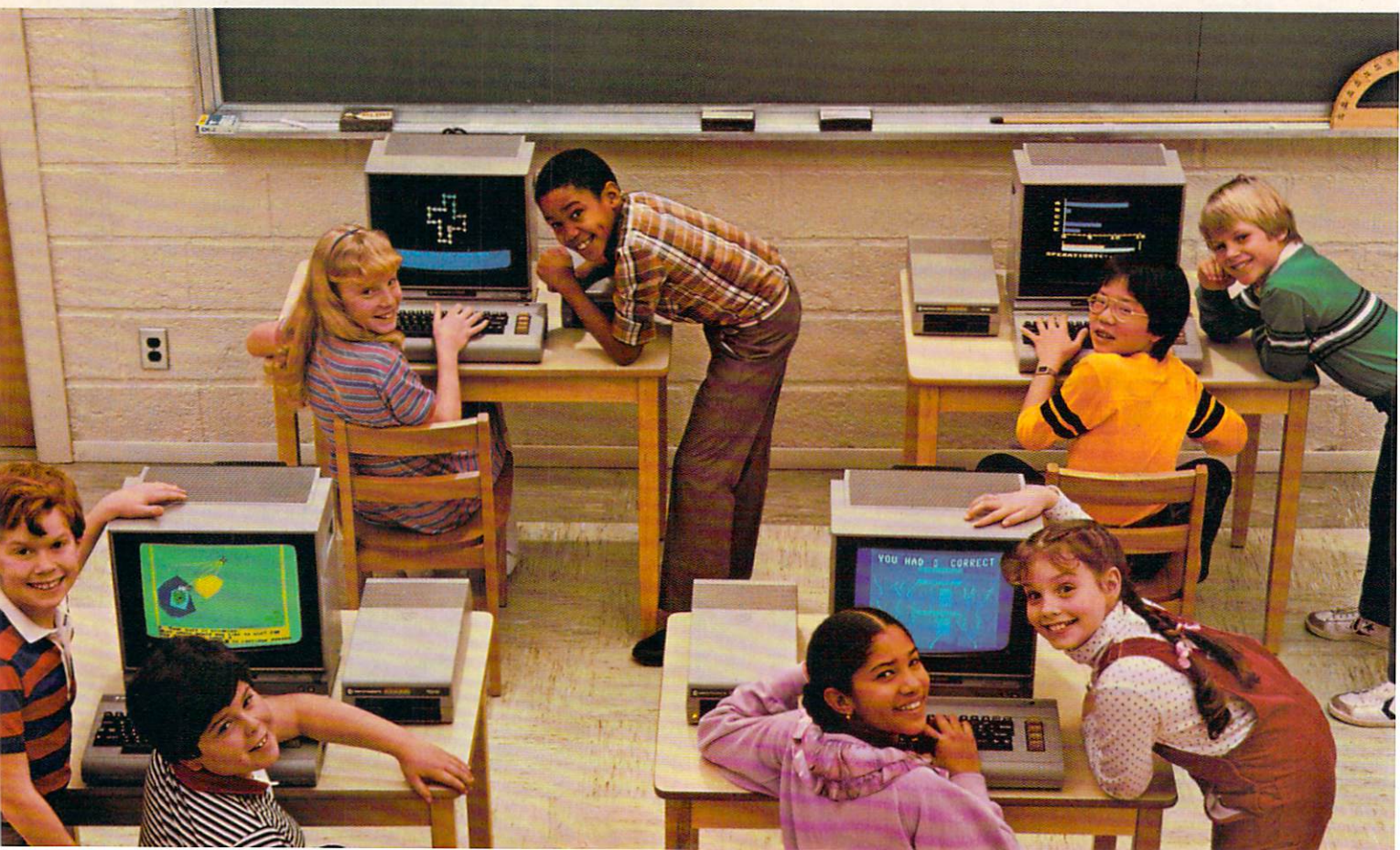
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A Printing Disassembler for the Commodore 64

This article is primarily for the machine language programmer and describes a disassembler that can dump its output to the printer. I've named the program DISDUMP and you can use it to disassemble and print out any region of memory. Using it to print copies of your machine language programs will make editing and debugging them much easier. And when a program at last ascends to its final form, you will welcome the sense of security that having a hard copy of it on file can bring.

But being able to generate hard copies of your programs is only one use for a printing disassembler. Another—and perhaps an even more important application—is to be able to get printed copies of the 64's BASIC ROM. Along with an annotated memory map, like *Mapping the Commodore 64*, by Sheldon Leemon, having hard copies of the ROM subroutines is an asset as you study them to discover how they may be called upon by your own programs. In this capacity, DISDUMP becomes an important aid for the ongoing self-education of the machine language programmer.

DISDUMP is a special-purpose disassembler. Although you may direct its output to the screen if you wish, its real purpose is to produce printed copies of machine language routines. As such, it is intended to augment, rather than to replace, the disassembler that is already included in the machine language monitor you are using.

To use DISDUMP, simply load your machine language program, then load DISDUMP and run. It will ask you to provide the decimal values of the starting and ending addresses of the machine language routine, will ask if you want the output to go to the printer or to the screen, and will pro-

DISDUMP is a special-purpose disassembler. Its real purpose is to produce printed copies of machine language routines.

ceed to perform the disassembly according to these specifications.

The sample run illustrates the use of DISDUMP to print out the ROM routine that executes BASIC's RESTORE command. In this sample, it was not necessary to first load a separate machine language program since the routine being disassembled is a permanent resident of BASIC ROM.

Because of its length, keying in DISDUMP will be more than just a trivial task. I feel compelled, therefore, to apprise you of its limitations before going any further. You need that information before you can reasonably decide whether or not to invest the time it will require to make DISDUMP a part of your program library.

As you can see, the program is written in BASIC. It uses BASIC RAM from 2048 to 12287 and is not compatible with machine language programs that overlap this region of memory. Then too, because DISDUMP is written in BASIC, it is somewhat slower than disassemblers written in machine language. However, I have not found this to be a significant problem at all and am quite comfortable with its speed.

If these points have not dissuaded you, it is time to go on to the detailed information you will need in order to get DISDUMP up and running in your system.

Space limitations make it impossible to provide a line-by-line discussion of the entire program and force me to concentrate only on those points that are directly pertinent to getting DISDUMP to work for you. The first of these is to deal with that big question that you must ask when-

ever you are offered a program that claims to work with a printer. That is: will it work without modification on your unit? Owners of Star Gemini printers receive an emphatic yes to that question and can skip the next two paragraphs. (That is their reward for choosing the same printer that I have.) The rest of you have a little extra work to do before you start typing.

Rather than provide specific instructions for just a few other printers, I will explain what each of the printer instructions in the program must accomplish. Then, regardless of the printer you are using, you will need only to turn to your owner's manual, find the instructions that your unit must be given to accomplish the same actions and replace mine with yours. This approach may create a little more work for everyone, but it allows the program to be modified to suit virtually every printer that may be out there.

The printer is first awakened by program line 450. It is here that a channel is first opened to the printer. Then, on the same line, CMD4 directs the computer's output to it. These are BASIC commands and are not unique to any particular printer model.

Line 460 is where your work really begins. When this line is executed, it clears the current horizontal tab settings and sets new tabs at columns 7, 13, 16, 19 and 23. Replace line 460 with the instruction that your printer's manual tells you to use to do the same thing. If you need more program lines, you can insert them, assigning line numbers from 460 through 469.

Next look at lines 920 to 950. It is here that the printing is actually done. Each time CHR\$(9) appears on these lines, it directs the print head to move to the next horizontal tab location. The tabs will, of course, be the ones that you set back on line 460. Replace my CHR\$(9)'s with the instruction that your printer requires to accomplish the same end and your editing is complete. Line 2700 simply closes the channel to the printer.

On line 170, the top of BASIC RAM is set to 12287 (\$2FFF, hexadecimal) so that the variables stored by DISDUMP will not overwrite a machine lan-

guage program located above this address. This was included so there would be as much continuous RAM as possible left free of DISDUMP's interference. After the program run is complete, the top of RAM remains set here, but it can be reset to its default value by simply switching the computer off and back on again. **C**

DISDUMP

```

100 REM *****'BVBY
110 REM ** DISDUMP **'BLBY
120 REM ** M.W. CAPRIO **'BOTA
150 REM ** 24 NOVEMBER 84 **'BQCE
160 REM *****'BVBF
170 POKE 55,255:POKE 56,47
:POKE 643,255:POKE 644,47:CLR'FDXK
180 POKE 53280,14:POKE 53281,12
:PRINT"[GRAY1]"'DSWI
190 REM ** TITLE PAGE **'BNNH
200 PRINT"[CLEAR,DOWN9]"'BAWW
210 PRINT TAB(12)"[RVS,SPACE16,RVOFF]
"'CDIB
220 PRINT TAB(12)"[RVS,SPACE5]DISDUMP
[SPACE4,RVOFF]"'CDTD
230 PRINT TAB(12)"[RVS,SPACE16,RVOFF]
"'CDID
240 PRINT TAB(12)"[RVS]
PROGRAM BY MWC [RVOFF]"'CDVG
250 PRINT TAB(12)"[RVS,SPACE16,RVOFF]
"'CDIF
260 FOR I=1 TO 1500:NEXT I'EICG
270 DIM F$(16)'BGRE
280 F$(0)="0":F$(1)="1":F$(2)="2"
:F$(3)="3":F$(4)="4":F$(5)="5"
:F$(6)="6":HQOS
290 F$(7)="7":F$(8)="8":F$(9)="9"
:F$(10)="A":F$(11)="B":FGNP
295 F$(12)="C":F$(13)="D":CNYO
300 F$(14)="E":F$(15)="F":CNHB
310 REM ** MAIN PROGRAM **'BPPC
320 PRINT"[CLEAR] THIS PROGRAM WILL
READ THE CONTENTS OF"'BAFK
330 PRINT" MEMORY AND[SPACE2]
OUTPUT THE OBJECT CODE AND"'BASK
340 PRINT" THE ASSEMBLY LANGUAGE
SOURCE CODE THAT"'BACM
350 PRINT" IT FINDS IN THE LOCATIONS
YOU REQUEST."BAIN
360 INPUT"[DOWN2]DO YOU WANT A
HARDCOPY (Y OR N)";HD$'BEKM
370 INPUT"[DOWN2]STARTING ADDRESS
(DECEMAL)";S'BCMM
380 INPUT"[SPACE2,DOWN2]
ENDING ADDRESS (DECEMAL)";E:E=E-1
:IF E+1>S THEN 410'INYT
390 PRINT" [DOWN]THE ENDING ADDRESS
MUST BE HIGH-"BALP
400 PRINT" ER THAN THE STARTING
ADDRESS.":FOR I=1 TO 2000:NEXT I
:GOTO 310'GNLM
410 INPUT"[DOWN2,SPACE14]
ARE YOU SURE";CS'BDCF
420 IF LEFT$(CS,1)<>"Y"THEN 310'FJVF
430 PRINT"[CLEAR]WORKING ..."BACF
440 IF LEFT$(HD$,1)<>"Y"THEN 470'FKBH
450 OPEN 4,4:CMD 4'CFLF
460 PRINT CHR$(27)"D"CHR$(7)CHR$(13)
CHR$(16)CHR$(19)CHR$(23)CHR$(0)'IBOO
470 NN=S:GOSUB 610:SS$=SS'DNSK
480 ML=PEEK(S)'CFBI
490 GOSUB 690'BDSI
500 IF N>0 THEN GOSUB 750'EFMC
510 GOSUB 870'BDSB
520 OP$=V$'BFNC
530 IF N=0 THEN 570'DFDE
540 FOR I=1 TO N'DDIF
550 ML=AD(I):GOSUB 870:AD$(I)=V$'DUUK
560 NEXT I'BBCF
570 IF HD$="Y"THEN GOSUB 910
:GOTO 590'FKRL
580 GOSUB 1030'BEFI
590 IF S=>E+1 THEN 2700'FHIM
600 N=0:S=S+1:C=C+1:AD$(1)=""
:AD$(2)=""GOTO 470'IDSL
610 REM ** CONVERT S TO HEX **'BRAG
620 SS$=""SS=INT(NN/4096)
:SS$=SS$+F$(SS)'GYSL
630 F1=NN-SS*4096'DKXH
640 SS=INT(F1/256):SS$=SS$+F$(SS)'FUEM
650 F2=F1-SS*256'DJIJ
660 SS=INT(F2/16):SS$=SS$+F$(SS)'FTGN
670 F3=F2-SS*16:SS$=SS$+F$(F3)'FTPO
680 RETURN'BAQI
690 REM ** READ DATA **'BMIM
700 RESTORE:FOR I=1 TO 151'EGXE
710 READ OP,CD$,N,SF$'BMUF
720 IF OP=ML THEN I=151'EIXH
730 NEXT I'BBCE
740 RETURN'BAQF
750 REM ** READ ADDITIONAL DATA **'BWTM
760 FOR I=1 TO N'DDIJ
770 S=S+1'CDAK
780 AD(I)=PEEK(S)'CIEM
790 NEXT I'BBCK
800 IF N=1 THEN 820'DFCE
810 T=AD(1):AD(1)=AD(2):AD(2)=T'DYEK
820 IF LEFT$(CD$,1)<>"B"THEN 860'FKBJ
830 IF AD(1)>127 THEN NN=S-(255-AD(1))
:GOTO 850'HAGO
840 NN=S+AD(1)+1'DJTK
850 GOSUB 610:D$=SS$'CINJ
860 RETURN'BAQI
870 REM ** CONVERT DEC TO HEX **'BTVO
880 V$=""F=INT(ML/16):V$=V$+F$(F)'GUF5
890 F1=ML-F*16:V$=V$+F$(F1)'FSES
900 RETURN'BAQD
910 REM ** OUTPUT TO PRINTER **'BTNJ
920 PRINT C CHR$(9);SS$;CHR$(9);OP$;
'DRVK
930 IF AD$(2)=""THEN PRINT CHR$(9);
AD$(1);CHR$(9);AD$(2);
:GOTO 950'HHNQ
940 PRINT CHR$(9);AD$(2);CHR$(9);
AD$(1);'DWAN

```

Continued next page

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950 PRINT CHR$(9);CD$;'CILL
960 IF N=0 THEN PRINT:GOTO 1020'FHDN
970 IF N=1 AND LEFT$(CD$,
    1)="B"THEN PRINT D$:GOTO 1020'IQYS
980 FOR I=1 TO N'DDIN
990 PRINT AD$(I);'BHXX
1000 NEXT I'BBCS
1010 PRINT SF$'BDKU
1020 RETURN'BAQU
1030 REM ** OUTPUT TO SCREEN **'BSNB
1040 CC=CC+1'CFCY
1050 PRINT C;TAB(6)SS$;TAB(13)OP$;'DPAD
1060 IF AD$(2)=" "THEN PRINT
    TAB(16)AD$(1);:GOTO 1080'GVFG
1070 PRINT TAB(16)AD$(2);
    TAB(19)AD$(1);'DUGF
1080 PRINT TAB(23)CD$;'CHAD
1090 IF N=0 THEN PRINT:GOTO 1150'FHHG
1100 IF N=1 AND LEFT$(CD$,
    1)="B"THEN PRINT D$:GOTO 1150'IQDC
1110 FOR I=1 TO N'DDIW
1120 PRINT AD$(I);'BHXX
1130 NEXT I'BBCW
1140 PRINT SF$'BDKY
1150 IF CC>20 THEN 1180'EIVD
1160 PRINT"[SPACE7]PRESS [RVS]RETURN
    [RVOFF] TO CONTINUE.":CC=0'CEQK
1170 GET C$:IF C$<>CHR$(13)THEN 1170'GNHG
1180 RETURN'BAQC
1190 DATA 0,"BRK",0," "'BFEF
1200 DATA 1,"ORA ($",1,"X)"'BFHX
1210 DATA 5,"ORA $",1," "'BFHX
1220 DATA 6,"ASL $",1," "'BFGY
1230 DATA 8,"PHP",0," "'BFVA
1240 DATA 9,"ORA #$",1," "'BFWB
1250 DATA 10,"ASL",0," "'BGEC
1260 DATA 13,"ORA $",2," "'BGFD
1270 DATA 14,"ASL #$",1," "'BGJF
1280 DATA 16,"BPL $",1," "'BGDF
1290 DATA 17,"ORA ($",1,"Y)"'BGNH
1300 DATA 21,"ORA $",1,"X"'BGYY
1310 DATA 22,"ASL $",1,"X"'BGXA
1320 DATA 24,"CLC",0," "'BGUA
1330 DATA 25,"ORA $",2,"Y"'BGFC
1340 DATA 29,"ORA $",2,"X"'BGID
1350 DATA 30,"ASL $",2,"X"'BGXE
1360 DATA 32,"JSR $",2," "'BGTE
1370 DATA 33,"AND ($",1,"X)"'BGUG
1380 DATA 36,"BIT $",1," "'BGGG
1390 DATA 37,"AND $",1," "'BGUH
1400 DATA 38,"ROL $",1," "'BGWY
1410 DATA 40,"PLP",0," "'BGTA
1420 DATA 41,"AND #$",1," "'BGBB
1430 DATA 42,"ROL",0," "'BGWC
1440 DATA 44,"BIT $",2," "'BGGD
1450 DATA 45,"AND $",2," "'BGUE
1460 DATA 46,"ROL $",2," "'BGWF
1470 DATA 48,"BMI $",1," "'BGCG
1480 DATA 49,"AND ($",1,"Y)"'BGDI
1490 DATA 53,"AND $",1,"X"'BGOJ
1500 DATA 54,"ROL $",1,"X"'BGQB
1510 DATA 56,"SEC",0," "'BGJB
1520 DATA 57,"AND $",2," "'BGXC
1530 DATA 61,"AND $",2,"X"'BGOE
1540 DATA 62,"ROL $",2,"X"'BGQF
1550 DATA 64,"RTI",0," "'BGDF
1560 DATA 65,"EOR ($",1,"X)"'BGTH
1570 DATA 69,"EOR $",1," "'BGTH
1580 DATA 70,"LSR $",1," "'BGWI
1590 DATA 72,"PHA",0," "'BGFJ
1600 DATA 73,"EOR #$",1," "'BGUC
1610 DATA 74,"LSR",0," "'BGGC
1620 DATA 76,"JMP $",2," "'BGTD
1630 DATA 77,"EOR $",2," "'BGTE
1640 DATA 78,"LSR $",2," "'BGBG
1650 DATA 80,"BVC $",1," "'BGBG
1660 DATA 81,"EOR ($",1,"Y)"'BGSI
1670 DATA 85,"EOR $",1,"X"'BGNJ
1680 DATA 86,"LSR $",1,"X"'BGAK
1690 DATA 88,"CLI",0," "'BGLK
1700 DATA 89,"EOR $",2,"Y"'BGTD
1710 DATA 93,"EOR $",2,"X"'BGNE
1720 DATA 94,"LSR $",2,"X"'BGAF
1730 DATA 96,"RTS",0," "'BGSF
1740 DATA 97,"ADC ($",1,"X)"'BGTH
1750 DATA 101,"ADC $",1," "'BHYH
1760 DATA 102,"ROR $",1," "'BHMJ
1770 DATA 104,"PLA",0," "'BHDJ
1780 DATA 105,"ADC #$",1," "'BHIL
1790 DATA 106,"ROR",0," "'BHCL
1800 DATA 108,"JMP ($",2,")"'BHIE
1810 DATA 109,"ADC $",2," "'BHDF
1820 DATA 110,"ROR $",2," "'BHMJ
1830 DATA 112,"BVS $",1," "'BHFH
1840 DATA 113,"ADC ($",1,"Y)"'BHII
1850 DATA 117,"ADC $",1,"X"'BHCJ
1860 DATA 118,"ROR $",1,"X"'BHVK
1870 DATA 120,"SET",0," "'BHFK
1880 DATA 121,"ADC $",2,"Y"'BHVM
1890 DATA 125,"ADC $",2,"X"'BHCN
1900 DATA 126,"ROR $",2,"X"'BHVF
1910 DATA 129,"STA ($",1,"X)"'BHUG
1920 DATA 132,"STY $",1," "'BHDH
1930 DATA 133,"STA $",1," "'BHFI
1940 DATA 134,"STX $",1," "'BHEJ
1950 DATA 136,"DEY",0," "'BHNJ
1960 DATA 138,"TXA",0," "'BHBK
1970 DATA 140,"STY $",2," "'BHDM
1980 DATA 141,"STA $",2," "'BHFN
1990 DATA 142,"STX $",2," "'BHEO
2000 DATA 144,"BCC $",1," "'BHBW
2010 DATA 145,"STA ($",1,"Y)"'BHIX
2020 DATA 148,"STY $",1,"X"'BHMY
2030 DATA 149,"STA $",1,"X"'BHOA
2040 DATA 150,"STX $",1,"Y"'BHFB
2050 DATA 152,"TYA",0," "'BHXB
2060 DATA 153,"STA $",2,"Y"'BHLD
2070 DATA 154,"TXS",0," "'BHRD
2080 DATA 157,"STA $",2,"X"'BHOF
2090 DATA 160,"LDY #$",1," "'BHRG
2100 DATA 161,"LDA ($",1,"X)"'BHXS
2110 DATA 162,"LDX #$",1," "'BHYS
2120 DATA 164,"LDY $",1," "'BHKA
2130 DATA 165,"LDA $",1," "'BHNB
2140 DATA 166,"LDX $",1," "'BHLA
2150 DATA 168,"TAY",0," "'BHFC

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2160 DATA 169,"LDA #",1," "'BHCE
2170 DATA 170,"TAX",0," "'BHWE
2180 DATA 172,"LDY #",2," "'BHKG
2190 DATA 173,"LDA #",2," "'BHNH
2200 DATA 174,"LDX #",2," "'BHLV
2210 DATA 176,"BCS #",1," "'BHWA
2220 DATA 177,"LDA ($",1,"),Y"'BHBB
2230 DATA 180,"LDY #",1,"X"'BHKC
2240 DATA 181,"LDA #",1,"X"'BHMD
2250 DATA 182,"LDX #",1,"Y"'BHME
2260 DATA 184,"CLV",0," "'BHTE
2270 DATA 185,"LDA #",2,"Y"'BHSG
2280 DATA 186,"TSX",0," "'BHWG
2290 DATA 188,"LDY #",2,"X"'BH TI
2300 DATA 189,"LDA #",2,"X"'BHVA
2310 DATA 192,"CPY #",1," "'BHAB
2320 DATA 193,"CMP ($",1,"X)"'BHNC
2330 DATA 196,"CPY #",1," "'BHSD
2340 DATA 197,"CMP #",1," "'BHHE
2350 DATA 198,"DEC #",1," "'BHOF
2360 DATA 200,"INY",0," "'BH TF
2370 DATA 201,"CMP #",1," "'BHEH
2380 DATA 202,"DEX",0," "'BHGH
2390 DATA 204,"CPY #",2," "'BHJJ
2400 DATA 205,"CMP #",2," "'BHYB
2410 DATA 206,"DEC #",2," "'BHFC
2420 DATA 208,"BNE #",1," "'BH PD
2430 DATA 209,"CMP ($",1,"),Y"'BHME
2440 DATA 213,"CMP #",1,"X"'BH XF

2450 DATA 214,"DEC #",1,"X"'BH EG
2460 DATA 216,"CLD",0," "'BHWG
2470 DATA 217,"CMP #",2,"Y"'BHEI
2480 DATA 221,"CMP #",2,"X"'BH XJ
2490 DATA 222,"DEC #",2,"X"'BHEK
2500 DATA 224,"CPX #",1," "'BHUC
2510 DATA 225,"SBC ($",1,"X)"'BHBD
2520 DATA 228,"CPX #",1," "'BHNE
2530 DATA 229,"SBC #",1," "'BHVF
2540 DATA 230,"INC #",1," "'BH PG
2550 DATA 232,"INX",0," "'BH XG
2560 DATA 233,"SBC #",1," "'BHBI
2570 DATA 234,"NOP",0," "'BH XI
2580 DATA 236,"CPX #",2," "'BH NK
2590 DATA 237,"SBC #",2," "'BH VL
2600 DATA 238,"INC #",2," "'BH YD
2610 DATA 240,"BEQ #",1," "'BH OE
2620 DATA 241,"SBC ($",1,"),Y"'BH HF
2630 DATA 245,"SBC #",1,"X"'BHUG
2640 DATA 246,"INC #",1,"X"'BH XH
2650 DATA 248,"SED",0," "'BHLH
2660 DATA 249,"SBC #",2,"Y"'BHBJ
2670 DATA 253,"SBC #",2,"X"'BHUK
2680 DATA 254,"INC #",2,"X"'BHXL
2690 DATA 2,"???",0," "'BFWL
2700 IF LEFT$(HD$,1)="Y" THEN PRINT#4
      :CLOSE 4'GKLH
2710 PRINT"[DOWN] COMPLETE." 'BAHF
2720 END'BACD

```

END

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ARAS.CALC—

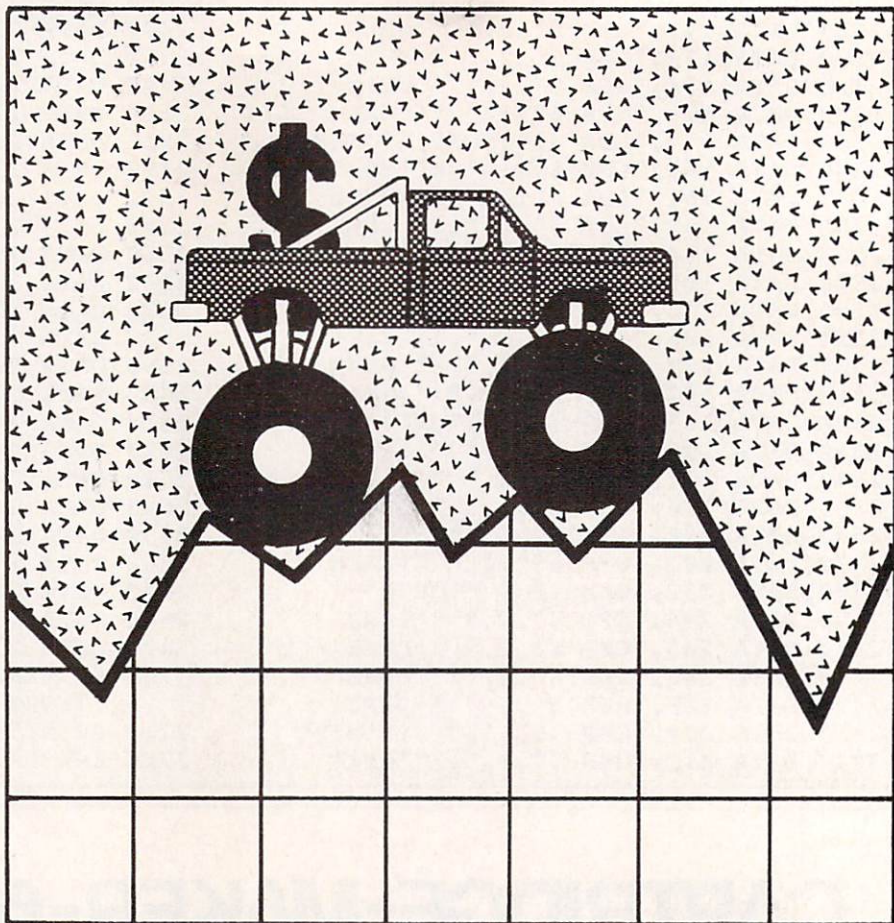
An Adjustable Rate Amortization Schedule for the Commodore 64

Until recently, a borrower seeking a loan generally amortized the loan at a fixed interest rate over a fixed period of time. However, during the recent inflationary period, lenders suffered financial losses on longterm loans that had been written at fixed interest rates significantly lower than the current rates—and in some instances lower than their cost of funds. As a result, loans with adjustable interest rates have gained widespread acceptance. The adjustment is based on the behavior of a selected index. To protect the consumer, the loan agreement may include a limitation on how much the interest rate can increase over a certain time interval and a limitation on how much the interest rate can increase over the term of the loan.

To entice borrowers to accept such an adjustable-rate loan, the lender usually sets the initial interest rate significantly lower than that of a fixed-rate loan of the same duration. Adjustable-rate loans are proving very popular with borrowers, especially home buyers.

However, in the event of an increase in the interest rate, the borrower may find that monthly payments escalate sharply. As a result, prudent borrowers will want to project possible future payments based on possible trends in interest rates. In particular, the borrower will want to consider the worst case, i.e., if the interest rates increase by the maximum amounts permitted by the loan contract.

Further, since adjustable-rate loans generally carry no prepayment penalty, the borrower may wish to consider what effect there will be on future monthly payments if various types of prepayment options are pursued. For example, to amortize a loan of \$60,000 over 30 years at an interest rate of 13% calls for a monthly pay-



Prudent borrowers will want to project possible future payments based on possible trends in interest rates.

ment of \$663.72. The total interest cost over the life of the loan is \$178,939.20. However, if the bor-

rower were to repay \$700 per month, the loan would be repaid in 21 years, five months at a total interest cost of \$111,452.37. If the borrower were to pay \$750 per month, the loan would be paid off in 16 years, seven months with a total interest cost of \$80,255.03. Quite a difference!

Using the Program

The program ARAS.CALC was written to help me investigate amortization schedules for various types of loans and choose the best options. The program is applicable to both fixed-rate and adjustable-rate loans. It also provides for various types of prepayments, which are discussed below.

When the program is run, the user will be asked to input the following data. The entry of an item is completed by pressing the RETURN key.

1. Loan amount: For a loan of \$60,000, enter 60000.
2. Term of the loan: Enter the number of years for repayment of the loan. The maximum term is

50 years because of the dimensions set in the arrays. Should a longer term be needed, the maximum can be easily altered by making the appropriate change in line 10 of the program.

3. Number of years to project: Enter the number of years for which the monthly payments are to be projected. This number will necessarily be, at most, the number entered as the term of the loan.
4. Interest rates: For each year to be projected, type in the interest rate expressed as a decimal. That is, for a rate of 10 7/8%, enter .10875. If you want a constant rate to be maintained from some year in the projection onward, this may be accomplished by entering a negative number, e.g., -1. In that case, the previously entered rate will be used for all future interest rates in the projection.
5. Additional payments: If no prepayments are to be made, type N. If prepayments are to be made, type Y. In the latter case, the user will be asked to select one of four options by typing the appropriate function key. The last choice would not be used at this time, but is useful later for the modification of previously entered data. The choices and the corresponding function keys are as follows:

- f1 additions to the prescribed monthly payments
- f3 additional payments to be made at the end of each loan year
- f5 set a total monthly payment
- f7 no additions to the prescribed monthly payment

Once the selection is made, the appropriate amount is entered (without dollar signs) for each year to be projected. The user may set some of the amounts equal to zero. As with the entry of the interest rates, inputting a negative number will cause all future amounts to be set equal to the previous one. If the option is chosen for a set total

If any prepayments are made at the end of the loan year, the balance must be adjusted by first subtracting the prepayment. Then determine the monthly payment for the following year.

monthly payment and if the selected payment in a given year is less than the payment required to amortize the loan, then this latter payment will be used instead.

After the computations are completed, a table is printed with four columns headed YEAR, RATE, PAYMENT and BALANCE. The third column contains the monthly payment required in the given year to amortize the loan at the given rate for the remainder of the term. If the additional payment option is selected, the additional amount to be paid will be printed beneath the required amount. The last column contains the balance that will still be outstanding at the end of the given year.

Only a portion of the table will appear on the screen at one time. The next portion of the table may be viewed by typing any key. When the table has been completely viewed, the total interest that would be paid during the projection period is displayed.

Modifying the Data

Next, a menu will be displayed on the screen, which provides the opportunity to modify any of the current data and to do another projection. The selection is made by typing the appropriate function key. The menu is as follows:

- f1 loan amount
- f2 term of loan
- f3 number of years to project
- f4 interest rates
- f5 additional payments

- f6 display current input data
- f7 print table
- f8 exit

The entry of data then follows as previously discussed.

About the Program

The heart of the program is in lines 300-415, where the financial calculations are performed:

M = monthly payment needed to amortize the loan

B = balance remaining to be paid

t = number of months remaining in the term of the loan

r = nominal interest rate on an annual basis

i = r/12

v = 1/(1 + i)

The formula relating these quantities is

$$M = \frac{Bi}{1 - v^t}$$

The calculation of the current monthly payment for a given year proceeds as though the current interest rate were to apply for the remainder of the term of the loan. If any prepayments are made at the end of the loan year, the balance must be adjusted by first subtracting the prepayment. Then determine the monthly payment for the following year.

If monthly prepayments are made, a different algorithm is used. Given the initial loan amount, the monthly payment for the first year is determined as above. Each month the total payment is first applied to pay any interest due (product of balance due at the beginning of the month with the interest rate i) and the rest of the payment is applied to reduce the balance due. This procedure is then iterated to obtain the necessary data for the projection period.

Since we need to round off to two decimal places, and the Commodore 64 does not support a round off function, the subroutine in lines 650-695 provides this capability. The subroutine rounds both 573.872 to 573.87. However, since some lenders always round up, you might want to round the first number to 573.88. C

Program next page

ARAS.CALC

```

2 REM ADJUSTABLE RATE AMORTIZATION
  SCHEDULE'BJKK
10 DIM R(50),MP(50),BL(50),AD(50),
  M$(50),B$(50),DD(50)'BWHG
15 FOR J=0 TO 50: AD(J)=0:NEXT
  :IA=0'GQIJ
25 GOSUB 500:GOSUB 510:GOSUB 520
  :GOSUB 530'EPJI
30 PRINT:PRINT"WILL THERE BE
  ADDITIONAL PAYMENTS TO"CBDK
35 PRINT"REDUCE THE PRINCIPAL? (Y=YES;
  N=NO)";:INPUT A$'CEAP
50 IF A$="Y"THEN GOSUB 570
  :GOTO 70'FIUF
60 IA=0'BDHD
70 GOSUB 300:GOSUB 200'CHUF
80 PRINT CHR$(147):PRINT"USE FUNCTION
  KEYS TO MODIFY INPUT DATA."DGKR
85 PRINT:PRINT"[RVS]F1[RVOFF]
  ...LOAN AMOUNT"CBMP
90 PRINT:PRINT"[RVS]F2[RVOFF]
  ...TERM OF LOAN"CBNL
95 PRINT:PRINT"[RVS]F3[RVOFF]
  ...NUMBER OF YEARS TO PROJECT"CBYU
100 PRINT:PRINT"[RVS]F4[RVOFF]
  ...INTEREST RATES"CBBC
105 PRINT:PRINT"[RVS]F5[RVOFF]
  ...ADDITIONAL PAYMENTS"CBAI
110 PRINT:PRINT"[RVS]F6[RVOFF]
  ...DISPLAY CURRENT INPUT
  DATA"CBRG
115 PRINT:PRINT"[RVS]F7[RVOFF]
  ...PRINT TABLE"CBJH
120 PRINT:PRINT"[RVS]F8[RVOFF]
  ...EXIT"CBQB
125 GET A$:IF A$=""THEN 125'EIHG
130 IF A$=CHR$(133)THEN GOSUB 500
  :GOTO 80'GNSE
135 IF A$=CHR$(137)THEN GOSUB 510
  :GOSUB 530:GOTO 80'HRSK
140 IF A$=CHR$(134)THEN GOSUB 520
  :GOTO 80'GNVF
145 IF A$=CHR$(138)THEN GOSUB 530
  :GOTO 80'GNBK
150 IF A$=CHR$(135)THEN GOSUB 570
  :GOTO 80'GNCG
155 IF A$=CHR$(139)THEN GOSUB 700
  :GOTO 80'GNBL
160 IF A$=CHR$(136)THEN GOSUB 300
  :GOSUB 200:GOTO 80'HRRI
165 IF A$=CHR$(140)THEN END'FHRK
170 PRINT:PRINT"INCORRECT KEY TYPED.
  TRY AGAIN":GOTO 80'DENM
200 JJ=0:JT=10:IF IA>0 THEN JT=5'GPND
201 C$="MONTHLY":IF IA=2 THEN C$="
  YEARLY"FIQG
202 NM=N:IF J1>0 THEN NM=J1'FLRE
205 FOR J=1 TO NM:IF JJ>0 THEN 232'GLAH
210 PRINT CHR$(147);SPC(12)
  "ADJUSTABLE RATE"DJRE
215 PRINT SPC(9)"AMORTIZATION
  SCHEDULE"CCTJ
220 PRINT:PRINT SPC(13)"LOAN AMOUNT
  :$";BL(0)'DKTF
225 PRINT:PRINT SPC(13)"TERM
  :";NY;" YEARS"DITJ
230 PRINT:PRINT"YEAR[SPACE3]RATE
  [SPACE5]PAYMENT[SPACE4]
  BALANCE"CBXI
232 X=MP(J):GOSUB 650:M$(J)=X$DSYH
233 X=BL(J):GOSUB 650:B$(J)=X$DSDH
235 PRINT J;TAB(6);R(J);TAB(15);"$";
  M$(J);TAB(26);"$";B$(J)'EGCN
245 IF IA>0 THEN X=AD(J):GOSUB 650
  :PRINT TAB(13);"+ $";X$;C$'HYXP
250 JJ=JJ+1:IF JJ<JT THEN 265'FNMH
255 JJ=0:GOSUB 780'CHTI
265 NEXT:IF JJ>0 THEN GOSUB 780'FHRL
269 PRINT CHR$(147):FOR Q=1 TO 5:PRINT
  :NEXT'HLNR
270 PRINT"TOTAL INTEREST PAID OVER
  THE PROJECTION"BAHO
275 PRINT"PERIOD OF";NM;" YEARS";'BFOO
280 IF J2>0 THEN PRINT"AND";J2;
  " MONTHS:";EIHL
283 X=TL:GOSUB 650'CHMK
285 PRINT:PRINT TAB(16)"$";X$'DHWM
290 GOSUB 780'BDSG
295 RETURN'BAQK
300 XB=BL(0):X=XB:TL=0:J1=0:J2=0
  :GOSUB 800'GCFH
302 FOR J=1 TO N'DDJB
303 AD(J)=DD(J)'BKTC
305 IR=R(J)/12:IF (IA=0 OR IA=2)THEN
  X=BL(J-1)'JYJN
307 GOSUB 450:MP(J)=X'CKLH
310 IF IA=1 THEN 350'DGEB
315 IF IA=3 THEN 410'DGDG
320 X=X*(1-V^(T-12))/IR:GOSUB 650'HRFH
330 BL(J)=X-AD(J)'CLDD
335 IF BL(J)<=0 THEN J1=J:J2=N
  :BL(J)=0'HTWO
340 TL=TL+12*MP(J)+BL(J)-BL(J-1)'GWBK
345 GOTO 395'BDQH
350 FOR JJ=1 TO 12'DFEE
355 X=XB*IR:GOSUB 650'DJBL
360 TL=TL+X:X=XB-MP(J)+X-AD(J)'GVUM
365 IF XB>0 THEN 390'DGWL
370 J1=J:J2=JJ'CIOH
375 XB=XB+AD(J)'CJAM
380 X=XB*IR:GOSUB 650'DJBJ
385 TL=TL+X:BL(J)=0:JJ=12:J=N'FUJS
390 NEXT JJ'BCWH
391 IF J1=0 THEN BL(J)=XB:X=XB'FOAN
395 NEXT'BAEL
400 RETURN'BAQX
410 IF MP(J)>AD(J)THEN AD(J)=0
  :GOTO 350'FUBG
415 AD(J)=AD(J)-MP(J):GOTO 350'DTWK
450 V=1/(1+IR)'DHWG
455 T=(NY-J+1)*12'EJUM
460 X=X*IR/(1-V^T)'FJSJ
465 GOSUB 650:RETURN'CEOK
500 PRINT CHR$(147):PRINT:PRINT
  :INPUT"AMOUNT OF LOAN";BL(0)
  :RETURN'GPMJ

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64 USERS ONLY

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510 PRINT CHR$(147):PRINT:PRINT
    :INPUT"TERM OF LOAN IN YEARS";
    NY'FLEL
515 NN=12*NY:RETURN'DHDI
520 PRINT CHR$(147):PRINT:PRINT
    :INPUT"NUMBER OF YEARS TO
    PROJECT";N:RETURN'GLCO
530 PRINT CHR$(147):PRINT
    :PRINT"ENTER INTEREST RATES FOR
    EACH YEAR TO BE"EHQ
531 PRINT CHR$(145)"PROJECTED.[SPACE2]
    THE ENTRY OF A NEGATIVE"CFUO
532 PRINT"NUMBER WILL MAINTAIN THE
    LAST RATE FOR"BARO
533 PRINT"THE REST OF THE
    PROJECTION."BAOM
535 IJ=0:FOR J=1 TO N'EHD
540 IF IJ>0 THEN 555'DGSG
545 PRINT"YEAR";J;:INPUT R(J)'CIHM
550 IF R(J)>0 THEN 560'DIEH
555 R(J)=R(J-1):IJ=1'DNYO
560 NEXT:RETURN'CBXG
570 PRINT CHR$(147):PRINT
    :PRINT"ADDITIONAL PAYMENTS MAY BE
    MADE MONTHLY"EHYU
571 PRINT"OR YEARLY OR MAY BE
    CANCELED."BABP
575 PRINT"[RVS]F1[RVOFF]
    ...ADDITIONAL MONTHLY PAYMENTS
    DURING"BA BX
576 PRINT SPC(5)"THE YEAR"CCNP
580 PRINT"[RVS]F3[RVOFF]
    ...ADDITIONAL YEARLY
    PAYMENTS"BAOQ
583 PRINT"[RVS]F5[RVOFF]
    ...SET A TOTAL MONTHLY
    PAYMENT"BAQT
584 PRINT"[RVS]F7[RVOFF]
    ...NO ADDITIONAL PAYMENTS"BAHT
585 GET A$:IF A$=""THEN 585'EIRQ
590 IF A$=CHR$(133)THEN IA=1
    :GOTO 600'GOOO
591 IF A$=CHR$(134)THEN IA=2
    :GOTO 600'GOQP
592 IF A$=CHR$(136)THEN IA=0
    :GOTO 640'GOUQ
595 IA=3:PRINT:PRINT"ENTER THE TOTAL
    DESIRED MONTHLY PAYMENT."DFYC
596 PRINT CHR$(145)"IF AMOUNT IS LESS
    THAN THE AMOUNT NEEDED"CFHC
597 PRINT CHR$(145)"TO AMORTIZE,
    THE LARGER AMOUNT WILL BE"CFYC
598 PRINT"USED.":GOTO 601'CELT
600 PRINT:PRINT:PRINT"ENTER
    ADDITIONAL AMOUNTS TO BE
    PAID."DCQL
601 PRINT"THE ENTRY OF A NEGATIVE
    NUMBER WILL"BATL
602 PRINT"MAINTAIN THE LAST AMOUNT
    FOR THE REST OF"BAKN
603 PRINT CHR$(145)"THE
    PROJECTION"CFKJ
610 IJ=0:FOR J=1 TO N'EHD

615 IF IJ>0 THEN 630'DGMJ
620 PRINT"YEAR";J;:INPUT AD(J)'CJIG
625 IF AD(J)>=0 THEN 635'EJFL
630 IJ=1:AD(J)=AD(J-1)'DPAI
635 DD(J)=AD(J):NEXT:RETURN'DMUM
640 FOR J=1 TO N:AD(J)=0:NEXT
    :RETURN'GMUK
650 XH=INT(X):XL=100*X-100*XH'GRRN
655 IF XL>=99.5 THEN XL=0:XH=XH+1
    :GOTO 665'ITEU
660 IF XL-INT(XL)>=.5 THEN
    XL=XL+1'INWO
665 XL$=STR$(INT(XL)):LL=LEN(XL$)-1
    :XL$=RIGHT$(XL$,LL)'IFGX
670 XH$=STR$(XH)'CHRK
675 IF XL=0 THEN XL$=""
    :GOTO 685'FKYR
680 IF XL<10 THEN XL$=""+XL$'FKHO
685 X$=XH$+"."+XL$'DIKR
690 X=VAL(X$)'CFFL
695 RETURN'BAQO
700 PRINT CHR$(147);TAB(91)"CURRENT
    INPUT DATA"DJSJ
705 PRINT:PRINT"LOAN AMOUNT
    : $";BL(0)'CHSM
710 PRINT:PRINT"TERM: ";NY;
    " YEARS"CFAH
715 PRINT:PRINT"PROJECTED FOR";N;
    " YEARS"CEOO
717 GOSUB 780'BDSK
720 PRINT CHR$(147):PRINT:PRINT
    :PRINT"INTEREST RATES:"FIBM
725 FOR J=1 TO N:PRINT R(J),'EJOM
730 IF J=4*INT(J/4)THEN PRINT'HGPJ
735 NEXT'BAEJ
737 GOSUB 780'BDSM
740 IF IA=0 THEN PRINT"NO PREPAYMENTS"
    :GOSUB 780'FHPN
741 IF IA=0 THEN FOR J=1 TO N:AD(J)=0
    :DD(J)=0:NEXT:RETURN'KWKR
745 IF IA=1 THEN PRINT CHR$(147):PRINT
    :PRINT'HKUQ
747 IF IA=1 THEN PRINT"ADDITIONAL
    MONTHLY PAYMENTS":GOTO 755'FHFY
750 IF IA=2 THEN PRINT CHR$(147):PRINT
    :PRINT'HKVM
752 IF IA=2 THEN PRINT"ADDITIONAL
    YEARLY PAYMENTS":GOTO 755'FHVU
753 IF IA=3 THEN PRINT CHR$(147):PRINT
    :PRINT:PRINT"TOTAL MONTHLY
    PAYMENTS"ILSW
755 FOR J=1 TO N'DDJN
757 PRINT DD(J),'BGGO
760 IF J=4*INT(J/4)THEN PRINT'HGPM
765 NEXT:GOSUB 785:RETURN'DFFO
780 PRINT:PRINT"HIT ANY KEY TO
    CONTINUE."CBKQ
785 GET A$:IF A$=""THEN 785'EITS
790 RETURN'BAQK
800 PRINT CHR$(147);TAB(206)
    "CALCULATIONS BEING
    PERFORMED"DKIN
805 RETURN'BAQH

```

(END)

Budget Master for the Commodore 64

Budget Master is a user-friendly budget program that helps you manage 16 expenses per month. The program records the ideal and real expenses each month, the amount of deviation from your ideal budget, and calculates the money remaining after all the budgeted items are paid. Data is saved to disk in sequential files that can be easily updated. In addition, the program can create reports of one to 12 months in length to help track the progress of your budget.

Main Menu

The following options are available from the main program menu:

- C Current budget to screen.
- D Disk command menu.
- E Enter/alter monthly data.
- L Load data file.
- P Print current budget.
- R Report generator.
- S Save current budget.
- Q Quit budget program.

Selections C, D, E and P branch immediately to the proper routine, but L, Q, R and S first display an "ARE YOU SURE?" prompt which must be answered "Y" in order to continue. This safety feature is essential because these latter selections change or eliminate data in memory, on disk or both.

When first run, Budget Master sets the budget file name to MON-YR and income to zero. The real life name and income will be established by you later. Income is set in the Enter/Alter section of the program and the file is named in the Save portion of the program.

Current Budget to Screen

Selecting C causes the current budget to be displayed on the screen, with the data organized in four columns. The left column (ITEM#) contains the items you have decided should be in your budget. The second column (IDEAL) contains the maxi-

The program records the ideal and real expenses each month, the amount of deviation from your ideal budget, and calculates the money remaining after all the budgeted items are paid.

mum amount you feel should be spent each month on these items. The third column (REAL) holds the actual amount spent to date for the items and the fourth column (DIFF.) displays the ideal amount minus the real amount. At the bottom of the screen is the income, ideal balance (income minus the total ideal amount) and the actual balance (income minus the total real amount).

If the actual balance and the ideal balance are the same, your budget is right on target. If the actual balance is larger than the ideal balance, you are money ahead. If the ideal balance is larger than the actual balance, you have over-spent again! Hit any key to return to the menu.

Disk Command Menu

Select D for a menu of disk commands:

- D Directory.
- R Rename file.
- S Scratch file.
- F Format new disk.
- I Initialize drive.
- V Validate disk.

Selecting D displays the disk directory. Any key will pause the listing and any key except RETURN will continue the listing. The RETURN key, after pausing, returns you to the disk menu. After the entire directory has been listed, any key (including RETURN) will return you to the disk menu.

Selecting R allows you to rename a file. You must supply a new file name and an old file name. Pressing RE-

TURN without entering a name will return you to the disk menu.

Choose Scratch (S) or Format (F) to eliminate data from the disk. Scratch eliminates a selected file, but Format eliminates everything on the disk (including the Budget Master program). You should always check to see if the correct disk is in the drive prior to using the Format option.

To format a disk, you must supply a name for the disk (maximum length of 16 characters) and a unique two-character ID code. A disk name longer than 16 characters or an ID code of more than two characters will cause the program to return to the beginning of the Format option. You will need to enter both the disk name and ID again. To return to the disk menu, press RETURN without entering anything.

Select I to initialize the drive (put the disk drive in the same condition as if it were just turned on) or V to validate a disk. Use RETURN alone to go from the disk menu to the main program menu.

Enter/Alter Monthly Data

Choosing E from the main menu brings up the same screen display as selection C (without the income and balance display) and offers the following options:

1. Select an item number from one to 16 for data entry.
2. Enter IN to change the monthly income.
3. Press RETURN alone for main menu.

If you choose to alter an item or change the income, follow your entry with RETURN. The changes you make (other than income) can be only for REAL budget amounts, because the DIFF. column is calculated for you and the IDEAL amounts are stored in data statements, which cannot be altered while the program is running.

If you elect to change an item or the income, the program will display the current value and ask for the new amount. If you wish to increase the current value, type a plus sign and the amount to be added. If you want to decrease the current value, use the minus sign and the amount to be subtracted. The program will not accept amounts without the plus or minus

sign as the first character. For screen formatting purposes, enter whole dollar amounts only. If you change your mind and no longer want to alter the current value, press RETURN alone. After an entry, the program displays the updated budget and asks for the next item to be altered.

Print Current Budget

To print a copy of the current budget, select P from the main menu. Prior to printing, you must respond "Y" to the "PRINTER READY?" prompt or the printout will be canceled. After a copy is printed, you have the option of reprinting. A response other than "Y" to the "ANOTHER COPY?" prompt will return you to the menu.

Two copies fit onto the same page if the printer is positioned as close to the top of the paper as possible. If you want copies on different pages, manually advance the printer to the next page prior to reprinting.

Save Current Budget

Select S from the main menu to save a monthly budget to disk. Prior to saving the file, the file name is displayed and you must verify that it is correct. Answer "Y" to save the budget file or "N" to change the file name (you will be asked to input a month and year). Budget Master uses the first three letters of the month and the last two digits of the year for the file name. In other words, inputting JANUARY and 1985 results in the file name JAN-85. Press RETURN to go back to the main menu.

Files are saved with the "Save with Replace" command, so a file on disk with the same name as the one you are saving will be eliminated. If you own an older 1541 disk drive, you should scratch the old file (see Disk Command Menu) prior to saving.

Load Data File

Choose L to load a file from disk. Operation of the Load option is identical to Save. You must verify or change the file name prior to loading. Attempting to load a file that does not exist will cause current memory to be cleared and you will be returned to the main menu.

Report Generator

Select R to access the report generator. By supplying the number of

To customize the budget, you change the ITEMS in the budget and alter the values of the IDEAL amounts.

months to be included in the report, a starting month and the year, one to 12 months of data files can be combined into a single report. Reports can be produced on screen or printer. The only limitation is that consecutive months must be used in producing a report. JAN-84, FEB-84 and MAR-84, for example, could be in a three-month report, but APR-84, MAY-83 and JUN-85 could not. A year change is automatic, so DEC-84 and JAN-85 can be in the same report.

When reporting to the screen, the data is presented in the same format as when choosing the C option from the menu. Hit any key and the screen displays the Report Totals—total income, total ideal balance and total actual balance of all the months reported. Hit any key and the next month to be reported will be loaded and displayed (unless the last month to be reported has already been displayed, in which case you will be returned to the menu). Attempting to report a non-existing file will terminate the report, clear memory and return to the menu.

Printing reports is easy. After the program loads the proper file, it asks if the printer is aligned properly (as close to the top of the paper as possible). Answer "Y" to print the report. Any other response will cause the report to terminate and return you to the menu. When printing reports, totals are not printed until:

- All months have been reported.
- The report is terminated by trying to load a non-existent file.
- You respond other than "Y" to the "PRINTER READY?" prompt.

If the number of months in a report is odd, the printer skips down four lines to print the totals. If the number of months in a report is even, the printer advances to the middle of the next page before printing the totals.

Quit

Choosing Q will quit the budget program and should only be used when you are finished working and have saved the current budget. If you should press the RUN/STOP key by mistake during program operation or goof and quit the program before saving a budget, do not despair. Type GOTO100 and press RETURN and you will be returned to the main program menu with all of your budget data unharmed. This will not work, however, if you have altered a program line.

Program Overview

Line	Function of Code
18-55	Initialization.
100-190	Main menu loop.
200-298	Screen display.
300-375	Input amounts.
400-498	Print a budget.
500-530	Save a file.
600-645	Load a file.
700-779	Generate reports.
798	Clear headers.
800	Quit.
900-910	Clear budget memory.
920	Zero report totals.
930-945	"Are you sure?" prompt.
950	Calculate the difference between the ideal and real amounts.
960	Zero budget totals.
970	Calculate budget totals.
975	Restore headers.
976	Zero actual and difference amounts.
980-991	Establish file name.
992-997	Align columns.
998-999	Invalid input routine.
1010-1080	Evaluate menu selection.
1090-1100	Get a single character.
1110-1130	Establish next file name for reports.
2003-2023	Header and ideal budget data.
2050-2130	Disk menu loop.
2135-2222	Directory.
2225-2260	Rename.
2265-2290	Scratch.
2295-2350	Format.
2355-2360	Initialize.
2365-2370	Validate.

Altering Budget Master

In order to customize the budget, you will want to change the ITEMS in the budget and alter the values of the IDEAL amounts. These changes are easy to make because the item headers and ideal budget amounts are located in data statements.

1. List lines 2009–2011 to display the data statements for the 16 budget item headers.

2. List lines 2022–2023 to display the data statements containing the ideal values that correspond to the item headers.
3. Item headers must be five characters in length, including any spaces, as longer or shorter headers will alter the screen and printer formatting. Make sure the position of the dollar amounts in 2022–2023 corresponds with the position of the

headers for which they are intended in lines 2009–2011.

NOTE: Loading a file causes the budget items and ideal amounts in screen displays and reports to be the same as when the file was originally saved.

I sincerely hope you have as much fun using this program as I had writing it. I also hope that you have better luck sticking to your budget than I have sticking to mine!

C

Budget Master

```

18 PRINT "[CLEAR]":POKE 53280,0
   :POKE 53281,0'DQOK
19 PRINT "[DOWN3, GREEN, RVS]
   *****
   *****";'BBNN
20 PRINT "[RVS]*[SPACE13]BUDGET-MASTER
   [SPACE12]*";'BBDG
21 PRINT "[RVS]**[SPACE17]BY[SPACE17]
   ***";'BBKF
22 PRINT "[RVS]*[SPACE11]
   DENNIS BLOOMFIELD[SPACE10]*";'BBTI
23 PRINT "[RVS]*****
   *****" 'BAXI
24 : 'ABHC
26 NI=16'BEAF
27 FL=0:P=0:MC$="JANFEBMARAPR MAYJUNJUL
   AUGSEP OCTNOV DECXXX" 'DKOV
28 IN$="0":HD$="[HOME, DOWN21]" 'CHCK
29 BL$="[SPACE40]" 'BDYN
30 DIM IS(NI):FOR DE=0 TO NI:READ AS
   :IS(DE)=AS:NEXT'HAGI
31 DIM HS(3):FOR DE=0 TO 3:READ AS
   :HS(DE)=AS:NEXT'HXKI
32 DIM AM(2,NI):FOR DE=1 TO NI:READ A
   :AM(0,DE)=A:NEXT'HCGL
33 AS$="":Z$="":O$="":ND$="MON-YR"
   :NA$=ND$:OF$="":NF$="":HCGO
35 M1$="[YELLOW]RETURN FOR MENU
   [L. BLUE]" 'BDOK
50 PRINT HD$;TAB(8);"[YELLOW]
   HIT ANY KEY TO CONTINUE" 'CHDK
55 GOSUB 1090'BEFH
100 P=0:PRINT "[CLEAR, DOWN, GREEN, RVS,
   SPACE17]MENU[SPACE19]";'CEFD
102 PRINT "[SPACE6]CURRENTLY WORKING ON
   :";NA$;"[SPACE6, RVOFF]";'BGQH
105 PRINT "[DOWN, SPACE8, YELLOW]C
   [L. BLUE]URRENT BUDGET TO
   SCREEN" 'BADJ
110 PRINT "[DOWN, SPACE8, YELLOW]E
   [L. BLUE]NTER/ALTER MONTHLY
   DATA" 'BANF
115 PRINT "[DOWN, SPACE8, YELLOW]P
   [L. BLUE]RINT CURRENT BUDGET" 'BAKJ
120 PRINT "[DOWN, SPACE8, YELLOW]S
   [L. BLUE]AVE CURRENT BUDGET" 'BAPF
125 PRINT "[DOWN, SPACE8, YELLOW]L
   [L. BLUE]OAD DATA FILE" 'BAMI
130 PRINT "[DOWN, SPACE8, YELLOW]R
   [L. BLUE]EPORT GENERATOR" 'BAYF
132 PRINT "[DOWN, SPACE8, YELLOW]D
   [L. BLUE]ISC COMMAND MENU" 'BAMH
135 PRINT "[DOWN, SPACE8, YELLOW]Q
   [L. BLUE]UIT BUDGET PROGRAM" 'BAYL
140 PRINT "[DOWN3, GREEN, RVS, SPACE15]
   SELECTION?[SPACE15]" 'BAUG
150 A=0:GOSUB 1090:GOSUB 1010
   :IF A<1 OR A>8 THEN GOSUB 998
   :GOTO 100'KYAL
155 IF A<4 OR A=7 THEN 180'FHEJ
160 GOSUB 930'BDPC
175 IF AS<>"Y" THEN 100'EFEK
180 ON A GOSUB 200,300,400,500,600,
   700,2050,800'CIK
190 FL=0:LC=0:GOTO 100'DLOI
200 SP$="[SPACE5]":PRINT "[CLEAR, RVS,
   GREEN, SPACE4]";:FOR DE=0 TO 1
   :PRINT HS(DE);SP$;:NEXT'HXTH
205 PRINT HS(2);:SP$="[SPACE2]"
   :PRINT SP$;HS(3);"[SPACE4, L. BLUE]
   ":GOSUB 960'EAEK
210 FOR DE=1 TO NI:GOSUB 950'EJPB
211 IF DE>10 THEN PRINT "[SPACE3]";
   'FFDC
212 IF DE<10 THEN PRINT "[SPACE4]";
   'EFJD
214 PRINT DE;IS(DE);:D=AM(0,DE)
   :GOSUB 992:PRINT SP$;'EETK
217 PRINT AM(0,DE);'BJBG
220 FOR R=1 TO 2:D=AM(R,DE):GOSUB 992
   :PRINT SP$;'GWAG
225 IF R=2 THEN 227'DFDG
226 PRINT AM(R,DE);:NEXT'CKRH
227 PRINT AM(R,DE):NEXT:NEXT'DKVI
228 PRINT "[SPACE4, CMDR Y31, SPACE6]";
   'BBQF
230 PRINT "[SPACE3, GREEN] ";IS(0);"
   [LEFT, SPACE2]";'BIEC
240 GOSUB 970:D=AM(0,0):GOSUB 992
   :PRINT SP$;'EVIH
250 PRINT AM(0,0);'BIMD
260 FOR R=1 TO 2:DE=0:D=AM(R,DE)
   :GOSUB 992:PRINT SP$;'HBJM
265 IF R=2 THEN 267'DFHK
266 PRINT AM(R,DE);:NEXT'CKRL
267 PRINT AM(R,DE):NEXT'CJIM
269 IF FL<>0 THEN 298'EGAO

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270 PRINT"[DOWN,L. BLUE,SPACE4,RVS]
INCOME:"+IN$+" IDEAL BALANCE
: ";(IN-AM(0,0))'EPHQ
280 PRINT"[SPACE10,RVS]ACTUAL BALANCE
: ";(IN-AM(1,0))'CMTN
296 PRINT HD$;"[DOWN2,SPACE8,YELLOW,
RVS]HIT ANY KEY TO CONTINUE
[L. BLUE]"'BEQV
297 GOSUB 1090:PRINT HD$;BL$;
:RETURN'DOBQ
298 RETURN'BAQN
300 FL=1:GOSUB 200:PRINT HD$;"[UP,
SPACE4,YELLOW,RVS,SPACE4]RETURN
IN , OR ITEM #[SPACE4,L. BLUE]
"'DMYK
310 N$="":PRINT HD$;:INPUT"[SPACE4]
ITEM NUMBER";N$'DLOF
312 IF N$="IN"THEN GOSUB 360
:GOTO 300'FJGF
313 IF N$=" "THEN 350'DFMD
314 N=VAL(N$)'CFKE
315 IF N>NI OR N<1 THEN GOSUB 998
:GOTO 310'HMFK
320 PRINT HD$;"[UP2,GREEN,SPACE4]
THE CURRENT VALUE OF ";IS(N);
" = ";AM(1,N)'BTCL
325 PRINT"[SPACE4,YELLOW,RVS,SPACE2]
RETURN, MENU,[SPACE2]
+ OR - AMOUNT [L. BLUE]"
:PRINT BL$'CEOP
330 Z$="":INPUT"[UP2,SPACE4]
NEW AMOUNT[SPACE3]";Z$'CGVH
331 IF Z$=" "THEN 300'DFTD
332 IF Z$="M"THEN 350'DFVF
333 O$=LEFT$(Z$,1)'CIYG
334 IF O$<>"+"AND O$<>"-"THEN 320'HHAK
335 M$=RIGHT$(Z$,LEN(Z$)-1)
:M=VAL(M$)'GSVN
336 IF O$="-"THEN AM(1,N)=AM(1,
N)-M'FRQN
337 IF O$="+"THEN AM(1,N)=AM(1,
N)+M'FRNO
340 GOTO 300'BDCC
350 PRINT"[GREEN]":RETURN'CBBD
360 PRINT HD$;"[SPACE4]
CURRENT INCOME IS: ";IN'BHYK
365 INPUT"[SPACE4]NEW INCOME";IN$'BEAM
366 IF IN$=" "THEN RETURN'EDTM
367 O$=LEFT$(IN$,1)'CJKN
368 IF O$<>"+"AND O$<>"-"THEN PRINT
HD$;"[DOWN]";BL$;"[UP]";
:GOTO 365'JSLV
369 M$=RIGHT$(IN$,LEN(IN$)-1)
:M=VAL(M$)'GURU
370 IF O$="-"THEN IN=IN-M'FHRJ
371 IF O$="+"THEN IN=IN+M'FHOK
375 IN$=STR$(IN):RETURN'DIYM
400 S2$="[SPACE11]":LC=LC+32'DKLD
401 PRINT"[CLEAR,DOWN5,RIGHT10,YELLOW,
RVS]PRINTER READY? (Y)"'BANH
402 PRINT"[RIGHT8,RVS]ANY OTHER KEY
TO ABORT":GOSUB 1090
:IF A$="Y"THEN 406'FLEM
403 IF A$<>"Y"AND P=0 THEN PRINT"
[DOWN2,RIGHT10,RVS]PRINT-OUT
[SPACE2]ABORTED"'HEON
404 IF A$<>"Y"AND P=>1 THEN PRINT"
[DOWN2,RIGHT10,RVS]
REPORT TERMINATED":RE=NM'JJMQ
405 FOR DE=1 TO 1000:NEXT:RETURN'FJNH
406 PRINT"[CLEAR]":FOR DE=1 TO NI
:GOSUB 950:NEXT:GOSUB 960
:GOSUB 970:OPEN 4,4'JXIO
407 PRINT#4,S2$;S2$;"[SPACE6]";
CHR$(14);NA$;CHR$(15);
:PRINT#4,CHR$(10)'FHVP
408 PRINT#4,"[SPACE7]";:FOR R=0 TO 3
:PRINT#4,H$(R);:IF R<>3 THEN
PRINT#4,S2$;'KAIS
409 NEXT:PRINT#4,CHR$(13)'DHWK
410 FOR R=1 TO 68:PRINT#4,CHR$(163);
:NEXT'GOMF
411 FOR R=1 TO 3:PRINT#4:NEXT'FGDE
412 S2$="[SPACE8]"'BDPD
413 FOR DE=1 TO NI'DFOF
415 IF DE<10 THEN PRINT#4,"[SPACE3]";
'EHWI
416 IF DE=>10 THEN PRINT#4,"[SPACE2]";
'FHQJ
420 PRINT#4,DE;"-";IS(DE);'BNQD
425 FOR R=0 TO 2:D=AM(R,DE)
:GOSUB 992'FRMM
430 PRINT#4,S2$+SP$;'CJBE
432 IF R=3 THEN PRINT#4,"[SPACE2]";
'EFTG
435 PRINT#4,AM(R,DE);:NEXT:PRINT#4
:NEXT'EPAL
440 PRINT#4:PRINT#4:FOR R=1 TO 68
:PRINT#4,CHR$(163);:NEXT'ISYK
442 GOSUB 960:PRINT#4:PRINT#4,"
[SPACE5]";IS(0);" ";'DQTJ
445 GOSUB 970:FOR R=0 TO 2:DE=0
:D=AM(R,DE):GOSUB 992'HAYR
450 PRINT#4,S2$+SP$;'CJBG
452 IF R=3 THEN PRINT#4,"[SPACE2]";
'EFTI
455 PRINT#4,AM(R,DE);:NEXT:PRINT#4'DOSM
460 PRINT#4:PRINT#4,"[SPACE18]
INCOME . . . . .";'CFBN
462 D=IN:GOSUB 992:PRINT#4,SP$;D'DPLL
465 PRINT#4,"[SPACE18]IDEAL BALANCE
[SPACE2]. . . . .";'BDRR
467 D=(IN-AM(0,0)):GOSUB 992
:PRINT#4,SP$;D'EYOS
470 PRINT#4,"[SPACE18]ACTUAL BALANCE
. . . . .";'BDCN
472 D=(IN-AM(1,0)):GOSUB 992
:PRINT#4,SP$;D'EYPO
474 IF P>0 THEN 496'DFGM
475 PRINT"[DOWN2,RIGHT10]
ANOTHER COPY? (Y)"'BAVQ
478 GOSUB 1090:IF A$<>"Y"THEN 496'FKLS
488 IF LC>32 THEN LC=0:FOR R=1 TO 2
:PRINT#4:NEXT'JOHW
490 PRINT#4:CLOSE 4:PRINT"[CLEAR]"

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Continued next page

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:FOR DE=1 TO 1000:NEXT
:GOTO 400'IRXP
495 IF LC>32 THEN LC=0:FOR R=1 TO 2
:PRINT#4:NEXT:GOTO 497'KSEW
496 IF LC>32 THEN LC=0'EHVR
497 PRINT#4:CLOSE 4'CDRP
498 RETURN'BAQP
500 PRINT"[CLEAR,L. BLUE,DOWN4,RIGHT4]
";M1$'BERC
501 PRINT"[DOWN2,RIGHT4]FILE TO SAVE
: [YELLOW]";NA$:PRINT"[L. BLUE,
DOWN2,RIGHT4]FILENAME OK?
(Y-N)""CFEM
502 GOSUB 1090:IF A$=CHR$(13) THEN
RETURN'GLCG
503 IF A$<>"Y" THEN GOSUB 980
:GOTO 500'GJSH
507 PRINT"[DOWN2,RIGHT4]SAVING
: [YELLOW]";NA$'BEDK
510 OPEN 15,8,15'BHAB
511 OPEN 2,8,2,"@0:"+NA$+",S,W""DJUG
515 PRINT#2,IN$'BFBG
516 FOR DE=0 TO NI'DFNJ
517 PRINT#2,IS(DE)'BIKJ
518 NEXT'BAEI
520 FOR DE=0 TO NI'DFNE
521 FOR R=0 TO 2'DDNE
522 PRINT#2,AM(R,DE)'BKTF
523 NEXT'BAEE
524 NEXT'BAEF
530 FL=FL+1:GOSUB 630:RETURN'EKQG
600 PRINT"[CLEAR,L. BLUE,DOWN4,RIGHT4]
";M1$'BERD
601 PRINT"[DOWN2,RIGHT4]FILE TO LOAD
: [YELLOW]";NA$:PRINT"[L. BLUE,
DOWN2,RIGHT4]FILENAME OK?
(Y-N)""CFON
602 GOSUB 1090:IF A$=CHR$(13) THEN
RETURN'GLCH
603 IF A$<>"Y" THEN GOSUB 980
:GOTO 600'GJTI
606 PRINT"[DOWN2,RIGHT4]LOADING
: [YELLOW]";NA$'BECL
610 OPEN 15,8,15'BHAC
611 OPEN 2,8,2,"@0:"+NA$+",S,R""DJAH
615 INPUT#2,IN$'BFBG
616 IN=VAL(IN$)'CHAK
617 FOR DE=0 TO NI'DFNL
618 INPUT#2,IS(DE)'BIPL
619 NEXT'BAEK
620 FOR DE=0 TO NI'DFNF
621 FOR R=0 TO 2'DDNF
622 INPUT#2,AM(R,DE)'BKYG
623 NEXT'BAEF
624 NEXT'BAEG
630 INPUT#15,E1$,E2$,E3$,E4$'BSIH
635 PRINT"[SPACE4]";E1$;" ";E2$;" ";
E3$;" ";E4$;" ":FOR DE=1 TO 700
:NEXT'FDCR
636 IF E2$<>"OK"AND P=0 AND FL=0 THEN
GOSUB 900'JLVR
640 CLOSE 2'BBJE
645 CLOSE 15,8,15:RETURN'CIUL
700 PRINT"[CLEAR,DOWN4,RIGHT4]";M1$
:PRINT"[DOWN,RIGHT4,YELLOW,RVS]P
[RVOFF]RINTER OR [YELLOW,RVS]S
[RVOFF]CREEN?"'CFGM
701 GOSUB 1090:IF A$=CHR$(13) THEN
RETURN'GLCH
702 IF A$<>"P"AND A$<>"S" THEN GOSUB
998:PRINT"[CLEAR,DOWN6,YELLOW,
RIGHT6]";:GOTO 700'KNDO
703 GOSUB 920'BD0F
705 PRINT"[DOWN3,RIGHT4,YELLOW]
STARTING":GOSUB 981
:IF NA$=ND$ THEN RETURN'GLIP
710 INPUT"[DOWN,RIGHT4,YELLOW]
NUMBER OF MONTHS TO REPORT";NM
:IF NM=0 THEN RETURN'FHPP
711 IF NM>12 THEN 700'DHTG
715 IF A$="P" THEN 750'DFDK
720 FOR RE=1 TO NM:GOSUB 798
:PRINT"[CLEAR,DOWN5,RIGHT4]"
:GOSUB 606'GOJL
725 PRINT"[CLEAR,DOWN5,RIGHT6,GREEN,
RVS]REPORT FOR MONTH OF
: [YELLOW]";NA$;"[L. BLUE]"
:FOR DE=1 TO 2000:NEXT'FOFW
726 IF E2$="OK" THEN 730'DGFM
727 IF E2$<>"OK" THEN PRINT"[DOWN,
RIGHT6,YELLOW]";NA$;" ";E2$'FMBR
728 PRINT"[DOWN,RIGHT6]
REPORT TERMINATED[L. BLUE]"
:GOSUB 900:GOTO 742'DIVU
730 GOSUB 200:YI=YI+IN:Y1=Y1+(IN-AM(0,
0)):Y2=Y2+(IN-AM(1,0))'JRBT
735 PRINT"[CLEAR,DOWN5,RIGHT7]
REPORT TOTALS TO:[YELLOW] ";NA$;"
[L. BLUE]""BFYS
739 DE=0:PRINT"[DOWN2,RIGHT7]
INCOME TOTAL[SPACE5,YELLOW]";:D=YI
:GOSUB 992:PRINT SP$;YI'FUTB
740 PRINT"[DOWN,RIGHT7,L. BLUE]
IDEAL BAL. TOTAL [YELLOW]";:D=Y1
:GOSUB 992:PRINT SP$;Y1'EQMR
741 PRINT"[DOWN,RIGHT7,L. BLUE]
ACTUAL BAL. TOTAL[YELLOW]";:D=Y2
:GOSUB 992:PRINT SP$;Y2'EQYS
742 IF E2$="OK" THEN 745'DGLK
744 FOR DE=1 TO 2000:NEXT:RETURN'FJON
745 GOSUB 296'BDUL
746 IF RE=NM THEN 749'DHKO
747 GOSUB 1110'BEEN
748 NEXT:RETURN'CBXO
749 NEXT:RETURN'CBXP
750 FOR RE=1 TO NM:P=P+1
:GOSUB 798'GNQN
753 PRINT"[CLEAR,DOWN5,RIGHT4]"
:GOSUB 606'CENM
754 IF E2$<>"OK" THEN 756'EGKO
755 GOTO 760'BDMM
756 PRINT"[CLEAR,DOWN5,RVS]";NA$;" ";
E2$;"--REPORT TERMINATED" 'BKQV
757 OPEN 4,4:PRINT#4:PRINT#4
:PRINT#4'EJSR
758 PRINT#4,"[SPACE14]";NA$;" ";E2$;

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64 USERS ONLY

```

"-REPORT TERMINATED"'BMGY
759 CLOSE 4,4:GOTO 765'CHCR
760 GOSUB 400:IF A$<>"Y"AND RE=NM AND
P=NM THEN 765'JQXR
761 YI=YI+IN:Y1=Y1+(IN-AM(0,0))
:Y2=Y2+(IN-AM(1,0))'INMW
763 GOSUB 1110'BEEL
764 NEXT'BAEL
765 OPEN 4,4:IF A$<>"Y"THEN 768'FJCR
766 IF LC=0 THEN FOR DE=1 TO 25
:PRINT#4:NEXT:GOTO 768'JPVV
767 IF LC=32 THEN FOR DE=1 TO 4
:PRINT#4:NEXT'ILTV
768 PRINT#4,"[SPACE27]REPORT TOTALS"
:PRINT#4'CEKY
770 PRINT#4,"[SPACE21]INCOME TOTAL
[SPACE5,YELLOW]";D=YI
:GOSUB 992'DLJT
771 PRINT#4,SP$;YI'BIFL
772 PRINT#4,"[SPACE21]IDEAL BAL.
TOTAL [YELLOW]";D=Y1
:GOSUB 992'DLDV
773 PRINT#4,SP$;Y1'BIGN
775 PRINT#4,"[SPACE21]ACTUAL BAL.
TOTAL[YELLOW]";D=Y2
:GOSUB 992'DLIA
776 PRINT#4,SP$;Y2'BIHQ
777 PRINT#4'BBDP
778 CLOSE 4'BBLQ
779 RETURN'BAQR
798 FOR DE=0 TO NI:IS(DE)="" :NEXT
:GOSUB 960:GOSUB 970:RETURN'IWUC
800 PRINT"[CLEAR,L. BLUE]":END'CBEE
900 GOSUB 976:GOSUB 975:DE=0:IN$=""
:IN=0'FTGK
910 GOSUB 950:NA$=ND$:RETURN'DLVI
920 YI=0:Y1=0:Y2=0:RETURN'EMCK
930 PRINT"[SPACE11,YELLOW,RVS]
ARE YOU SURE?(Y)[UP]"
:FOR DE=1 TO 300:NEXT'FIKR
935 PRINT"[SPACE27,UP]"
:FOR DE=1 TO 300:NEXT'FIOT
940 GET A$:IF A$=""THEN 930'EILL
945 RETURN'BAQM
950 AM(2,DE)=AM(0,DE)-AM(1,DE)
:RETURN'DAPP
960 FOR R=0 TO 2:AM(R,0)=0:NEXT
:RETURN'GOIP
970 FOR R=0 TO 2:FOR DE=1 TO NI
:AM(R,0)=AM(R,0)+AM(R,DE):NEXT
:NEXT:RETURN'LKTY
975 RESTORE:FOR DE=0 TO NI:READ A$
:IS(DE)=A$:NEXT:RETURN'IUVY
976 FOR R=1 TO 2:FOR DE=0 TO NI
:AM(R,DE)=0:NEXT:NEXT:RETURN'KWVC
980 PRINT"[CLEAR,DOWN8,RIGHT4,YELLOW]
RETURN TO ESCAPE[L. BLUE]"'BADS
981 NA$="" :M$="" :INPUT"[YELLOW,DOWN,
RIGHT4]MONTH NAME";M$
:IF M$=""THEN 990'GQGX
982 CH$=LEFT$(M$,3)'CJXQ
983 FOR DE=1 TO 34 STEP 3
:IF CH$=MID$(MC$,DE,
3)THEN 986'IXRY
984 NEXT'BAEP
985 GOSUB 998::GOTO 980'CIMS
986 Y$="" :INPUT"[RIGHT4]YEAR";Y$
:IF Y$=""THEN 990'FMOY
987 YR$=RIGHT$(Y$,2)'CJRV
988 NA$=NA$+CH$+CHR$(45)+YR$'FQVB
990 IF NA$=""THEN NA$=ND$'EJCQ
991 RETURN'BAQN
992 IF ABS(D)<10 THEN SP$="[SPACE5]"
:RETURN'GJNU
993 IF ABS(D)<100 THEN SP$="[SPACE4]"
:RETURN'GKEV
994 IF ABS(D)<1000 THEN SP$="[SPACE3]"
:RETURN'GLUW
995 IF ABS(D)<10000 THEN SP$="[SPACE2]"
:RETURN'GMLX
996 IF ABS(D)<100000 THEN SP$=""
:RETURN'GNCY
997 SP$="" :RETURN'CEOV
998 PRINT HD$;"[SPACE4,YELLOW,RVS]
INVALID INPUT, PLEASE DO AGAIN!
[L. BLUE]":FOR DE=1 TO 1500
:NEXT'FNAK
999 PRINT HD$;BL$:RETURN'CIDX
1010 IF A$="C"THEN A=1'EEBW
1020 IF A$="E"THEN A=2'EEEX
1030 IF A$="P"THEN A=3'EEQY
1040 IF A$="S"THEN A=4'EEUA
1050 IF A$="L"THEN A=5'EEOB
1060 IF A$="R"THEN A=6'EEVC
1070 IF A$="D"THEN A=7'EEID
1075 IF A$="Q"THEN A=8'EEWI
1080 RETURN'BAQB
1090 GET A$:IF A$=""THEN 1090'EJHG
1100 RETURN'BAQT
1110 FOR DE=1 TO 34 STEP 3'EGLX
1115 IF CH$=MID$(MC$,DE,
3)THEN NA$=(MID$(MC$,DE+3,
3))+""+YR$'JHKN
1120 NEXT:CH$=LEFT$(NA$,3)
:IF CH$<>"XXX"THEN RETURN'IPUF
1125 IF CH$="XXX"THEN CH$="JAN"
:Y=VAL(RIGHT$(NA$,2))'HRVL
1127 IF CH$="XXX"THEN NA$="" :NY=Y+1
:Y$=STR$(NY)'ISNN
1130 YR$=RIGHT$(Y$,2):NA$=CH$+"-"+YR$
:RETURN'GUUF
2003 DATA"TOTALS"'BAUY
2009 DATA"RENT ","FOOD ","CAR[SPACE2]
","PHONE","UTIL. ","GAS[SPACE2]
"'BFVM
2010 DATA"STOR. ","LOANC","WASH ","
"LIFED","LIFEC","CARIN",
"C-TV "'BEGG
2011 DATA"CLO. ","MISC. ","SAVE "'BCNA
2016 DATA"ITEM# ","IDEAL","REAL ",
"DIFF." 'BDKH
2022 DATA 565,425,220,25,30,80,0,
50'ABAD
2023 DATA 0,26,25,55,0,100,100,150'BYIE
2050 A=0:PRINT"[CLEAR,GREEN,RVS]";BL$;

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Continued next page


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      "[SPACE14]DISC OPTIONS[SPACE14]";
      BL$'CMAK
2055 PRINT "[DOWN2,RVOFF]";TAB(13);"
      [YELLOW]D[L.BLUE]IRECTORY"CFKK
2060 PRINT TAB(13);"[YELLOW]R[L.BLUE]
      ENAME FILE"CENG
2065 PRINT TAB(13);"[YELLOW]S[L.BLUE]
      CRATCH FILE"CETL
2070 PRINT TAB(13);"[YELLOW]F[L.BLUE]
      ORMAT DISK"CEQH
2075 PRINT TAB(13);"[YELLOW]I[L.BLUE]
      NITIALIZE DRIVE"CEQN
2077 PRINT TAB(13);"[YELLOW]V[L.BLUE]
      ALIDATE DISK"CEWO
2080 PRINT TAB(13);"[DOWN]";M1$'CIQE
2082 PRINT "[DOWN2,GREEN,RVS]";BL$;"
      [SPACE15]SELECTION?[SPACE15]";
      BL$'BJYN
2085 GOSUB 1090'BELI
2090 IF A$="D"THEN A=1'EECG
2095 IF A$="R"THEN A=2'EERL
2100 IF A$="S"THEN A=3'EETX
2105 IF A$="F"THEN A=4'EEHD
2110 IF A$="I"THEN A=5'EELY
2112 IF A$="V"THEN A=6'EEAB
2115 IF A$=CHR$(13)THEN RETURN'FGHF
2120 IF A<1 OR A>6 THEN 2050'FIUB
2125 ON A GOSUB 2135,2225,2265,2295,
      2355,2365'CFRJ
2130 GOTO 2050'BEEY
2135 PRINT "[CLEAR,DOWN3,RIGHT3,YELLOW]
      ANY KEY TO PAUSE/RESTART LISTING
      [L.BLUE]":PRINT:OPEN 1,8,0,
      "$0"'DIMS
2140 GET#1,A$,B$'BIYB
2145 GET#1,A$,B$'BIYG
2150 GET#1,A$,B$'BIYC
2155 C=0'BCLG
2160 IF A$<>" THEN C=ASC(A$)'GHHG
2165 IF B$<>" THEN C=C+ASC(B$)
      *256'ILNN
2167 IF C<10 THEN PRINT " ";EELY
2170 PRINT "[SPACE7]";MID$(STR$(C),2);
      TAB(4);"[SPACE2]";ENRI
2175 GET#1,B$:IF ST<>0 THEN 2215'FNWM
2180 IF B$<>CHR$(34)THEN 2175'FKXI
2185 GET#1,B$:IF B$<>CHR$(34)THEN
      PRINT B$;GOTO 2185'IUJR
2190 GET#1,B$:IF B$=CHR$(32)THEN
      2190'FQIK
2195 PRINT TAB(28);C$=""'DHRM
2200 C$=C$+B$:GET#1,B$:IF B$<>" THEN
      2200'HTYE
2205 PRINT LEFT$(C$,3)'CGTD
2206 GET A$:IF A$<>" THEN PRINT
      :PRINT "[RIGHT7]";M1$'HKDJ
2208 IF A$<>" THEN GOSUB 1090
      :IF A$=CHR$(13)THEN 2220'JRXN
2210 IF ST=0 THEN 2145'DHJA
2215 PRINT "[LEFT]BLOCKS FREE"BAOG
2220 CLOSE 1:IF A$=CHR$(13)THEN
      2222'FMBD
2221 PRINT:GOSUB 296'CEBB
2222 RETURN'BAQA
2225 PRINT "[CLEAR,DOWN5,RIGHT4]";
      M1$'BEKF
2228 OF$="" :INPUT "[DOWN3,RIGHT4]
      OLD FILENAME";OF$'CIQN
2229 IF OF$="" THEN 2260'DHCK
2230 NF$="" :INPUT "[DOWN,RIGHT4]
      NEW FILENAME";NF$'CIVF
2235 IF NF$="" THEN 2260'DHBH
2240 OPEN 15,8,15:PRINT#15,"R0
      :"+NF$+"="+OF$'FRCH
2245 INPUT#15,E1$,E2$,E3$,E4$'BSIJ
2250 PRINT "[DOWN,RIGHT4,YELLOW,RVS]";
      E1$;" ";E2$;" ";E3$;" ";E4$;"
      [RVOFF]":FOR DE=1 TO 1000
      :NEXT'FEEM
2255 CLOSE 15,8,15'BHBH
2260 RETURN'BAQC
2265 GOSUB 930:IF A$<>"Y"THEN
      2290'FKHM
2268 PRINT "[CLEAR,DOWN5,RIGHT4]";
      M1$'BEKM
2270 OF$="" :INPUT "[DOWN3,RIGHT4]
      FILENAME TO SCRATCH";OF$'CICM
2275 IF OF$="" THEN 2290'DHFL
2280 OPEN 15,8,15:PRINT#15,"S0
      :"+OF$'DOEJ
2285 GOSUB 2245'BEOK
2290 RETURN'BAQF
2295 GOSUB 930:IF A$<>"Y"THEN
      2350'FKEP
2298 PRINT "[CLEAR,DOWN5,RIGHT4]";
      M1$'BEKP
2300 PRINT "[DOWN2,RIGHT4]
      INPUT DISC NAME (16 CHAR.
      MAX)"BAPF
2302 OF$="" :INPUT "[DOWN,RIGHT4]NAME
      :";OF$'CIJE
2312 IF LEN(OF$)>16 THEN GOSUB 998
      :GOTO 2298'GPEG
2325 IF OF$="" THEN 2350'DHCH
2330 PRINT "[DOWN,RIGHT4]
      INPUT DISC ID CODE (2 CHAR.
      MAX)"BAIJ
2331 NF$="" :INPUT "[DOWN,RIGHT4]ID CODE
      :";NF$'CIBG
2332 IF LEN(NF$)>2 THEN GOSUB 998
      :GOTO 2298'GOAI
2335 IF NF$="" THEN 2350'DHBI
2340 OPEN 15,8,15:PRINT#15,"N0
      :"+OF$+" "+NF$'FRGI
2345 GOSUB 2245'BEOH
2350 RETURN'BAQC
2355 PRINT "[CLEAR,DOWN5,RIGHT11]
      INITIALIZING DRIVE"BAVO
2360 OPEN 15,8,15:PRINT#15,"I0:"
      :PRINT "[RIGHT7]";:GOSUB 2245
      :RETURN'FTXL
2365 PRINT "[CLEAR,DOWN5,RIGHT11]
      VALIDATING DISC"BAT0
2370 OPEN 15,8,15:PRINT#15,"V0:"
      :PRINT "[RIGHT7]";:GOSUB 2245
      :RETURN'FTLM

```

END

The programs which appear in this magazine have been run, tested and checked for bugs and errors. After a program is tested, it is printed on a letter quality printer with some formatting changes. This listing is then photographed directly and printed in the magazine. Using this method ensures the most error-free program listings possible.

Whenever you see a word inside brackets, such as [DOWN], the word represents a keystroke or series of keystrokes on the keyboard. The word [DOWN] would be entered by pressing the cursor-down key. If multiple keystrokes are required, the number will directly follow the word. For example, [DOWN4] would mean to press the cursor-down key four times. If there are multiple words within one set of brackets, enter the keystrokes directly after one another. For example, [DOWN, RIGHT 2] would mean to press the cursor-down key once and then the cursor-right key twice.

In addition to these graphic symbols, the keyboard graphics are all represented by a word and a letter. The word is either SHFT or CMD and represents the SHIFT key or the Commodore key. The letter is one of the letters on the keyboard. The combination [SHFT E] would be entered by holding down the SHIFT key and pressing the E. A number following the letter tells you how many times to type the letter. For example, [SHFT A4,CMD B3] would mean to hold the SHIFT key and press the A four times, then hold down the Commodore key and press the B three times.

The chart on this page tells you the keys to press for any word or words inside brackets. Refer to this chart whenever you aren't sure what keys to press. The little graphic next to each keystroke shows you what you will see on the screen.

SYNTAX ERROR

This is by far the most common error encountered while entering a program. Usually (sorry folks) this means that you have typed something incorrectly on the line the syntax error refers to. If you get the message "?Syntax Error Break In Line 270", type LIST 270 and press RE-

TURN. This will list line 270 to the screen. Look for any non-obvious mistakes like a zero in place of an O or vice-versa. Check for semicolons and colons reversed and extra or missing parenthesis. All of these things will cause a syntax error.

There is only one time a syntax error will tell you the 'wrong' line to look at. If the line the syntax error refers to has a function call (i.e., FN A(3)), the syntax error may be in the line that defines the function, rather than the line named in the error message. Look for a line near the beginning of the program (usually) that has DEF FN A(X) in it with an equation following it. Look for a typo in the equation part of this definition.

ILLEGAL QUANTITY ERROR

This is another common error message. This can also be caused by a typing error, but it is a little harder to find. Once again, list the line number that the error message refers to. There is probably a poke statement on this line. If there is, then the error is referring to what is trying to be poked. A number must be in the range of zero to 255 to be poke-able. For example, the statement POKE 1024,260 would produce an illegal quantity error because 260 is greater than 255.

Most often, the value being poked is a variable (A,X,...). This error is telling you that this variable is out of range. If the variable is being read

from data statements, then the problem is somewhere in the data statements. Check the data statements for missing commas or other typos.

If the variable is not coming from data statements, then the problem will be a little harder to find. Check each line that contains the variable for typing mistakes.




































OUT OF DATA ERROR

This error message is always related to the data statements in a program. If this error occurs, it means that the program has run out of data items before it was supposed to. It is usually caused by a problem or typo in the data statements. Check first to see if you have left out a whole line of data. Next, check for missing commas between numbers. Reading data from a page of a magazine can be a strain on the brain, so use a ruler or a piece of paper or anything else to help you keep track of where you are as you enter the data.

OTHER PROBLEMS

It is important to remember that the 64 and the PET/CBM computers will only accept a line up to 80 characters long. The VIC 20 will accept a line up to 88 characters long. Sometimes you will find a line in a program that runs over this number of characters. This is not a mistake in the listing. Sometimes programmers get so carried away crunching programs that they use abbreviated commands to get more than 80 (or 88)

CHART OF SPECIAL CHARACTER COMMANDS

 "[HOME]" = UNSHIFTED CLR/ HOME	 "[PURPLE]" = CONTROL 5	 "[F1]" = F1
 "[CLEAR]" = SHIFTED CLR/HOME	 "[GREEN]" = CONTROL 6	 "[F2]" = F2
 "[DOWN]" = CURSOR DOWN	 "[BLUE]" = CONTROL 7	 "[F3]" = F3
 "[UP]" = CURSOR UP	 "[YELLOW]" = CONTROL 8	 "[F4]" = F4
 "[RIGHT]" = CURSOR RIGHT	 "[ORANGE]" = COMMODORE 1	 "[F5]" = F5
 "[LEFT]" = CURSOR LEFT	 "[BROWN]" = COMMODORE 2	 "[F6]" = F6
 "[RVS]" = CONTROL 9	 "[L. RED]" = COMMODORE 3	 "[F7]" = F7
 "[RVOFF]" = CONTROL 0	 "[GRAY1]" = COMMODORE 4	 "[F8]" = F8
 "[BLACK]" = CONTROL 1	 "[GRAY2]" = COMMODORE 5	 "[POUND]" = ENGLISH
 "[WHITE]" = CONTROL 2	 "[L. GREEN]" = COMMODORE 6	 "[SHFT `]" = PI SYMBOL
 "[RED]" = CONTROL 3	 "[L. BLUE]" = COMMODORE 7	 "[↑]" = UP ARROW
 "[CYAN]" = CONTROL 4	 "[GRAY3]" = COMMODORE 8	

GRAPHIC SYMBOLS WILL BE REPRESENTED AS EITHER THE LETTERS SHFT (SHIFT) AND A KEY ("[SHFT Q,SHFT J,SHFT D,SHFT S]") OR THE LETTERS CMDR (COMMODORE) AND A KEY ("[CMDR Q,CMDR G,CMDR Y,CMDR H]"). IF A SYMBOL IS REPEATED, THE NUMBER OF REPETITIONS WILL BE DIRECTLY AFTER THE KEY AND BEFORE THE COMMA ("[SPACE3,SHFT S4,CMDR M2]").

characters on one line. You can enter these lines by abbreviating the commands when you enter the line. The abbreviations for BASIC commands are on pages 133-134 of the VIC 20 user guide and 130-131 of the Commodore 64 user's guide.

If you type a line that is longer than 80 (or 88) characters, the computer will act as if everything is ok, until you press RETURN. Then, a syntax error will be displayed.

THE PROGRAM WON'T RUN!!

This is the hardest of problems to resolve; no error message is displayed, but the program just doesn't run. This can be caused by many small mistakes typing a program in. First check that the program was written for the computer you are using. Check to see if you have left out any lines of the program. Check each line of the program for typos or missing parts. Finally, press the RUN/STOP key while the program is 'running'. Write down the line the program broke at and try to follow the program backwards from this point, looking for problems.

IF ALL ELSE FAILS

You've come to the end of your rope. You can't get the program to run and you can't find any errors in your typing. What do you do? As always, we suggest that you try a local user group for help. In a group of even just a dozen members, someone is bound to have typed in the same program.

If you do get a working copy, be sure to compare it to your own version so that you can learn from your errors and increase your understanding of programming.

If you live in the country, don't have a local user group, or you simply can't get any help, write to us. If you do write to us, include the following information about the program you are having problems with:

The name of the program

The issue of the magazine it was in

The computer you are using

Any error messages and the line numbers

Anything displayed on the screen

A printout of your listing (if possible)

Send your questions to:

Commodore Microcomputers

1200 Wilson Drive

West Chester, PA 19380

ATTN: Program Problem

C

How to Use the Magazine Entry Program

The Magazine Entry Program on page 123 is a machine language program that will assist you in entering the programs in this magazine correctly. It is for use with the Commodore 64 only and was written by Mark Robin using the IEA Editor/Assembler. Once the program is in place, it works its magic without you having to do anything else. The program will not let you enter a line if there is a typing mistake on it, and better yet, it identifies the kind of error for you.

Getting Started

Type in the Magazine Entry Program carefully and save it as you go along (just in case). Once the whole program is typed in, save it again on tape or disk. Now RUN the program. The word POKING will appear on the top of the screen with a number. The number will increment from 49152 up to 50052, and just lets you know that the program is running. If everything is ok, the program will finish running and end. Then type NEW. If there is a problem with the data statements, the program will tell you where to look to find the problem.

Once the program has run, it is in memory ready to go. To activate the program, type SYS49152 and press RETURN. When the READY prompt is displayed, type TEST and press RETURN. You are now ready to enter the programs from the magazine.

Typing the Programs

All the program listings in this magazine that are for the 64 have an apostrophe followed by four letters at the end of the line (i.e., 'ACDF'). The apostrophe and letters *should* be entered along with the rest of the line. This is a checksum that the Magazine Entry Program uses.

Enter the line and the letters at the end and then press RETURN, just as you normally would.

If the line is entered correctly, a bell is sounded and the line is entered into the computer's memory (without the characters at the end).

If a mistake was made while entering the line, a noise is sounded and an error message is displayed. Read the error message, then press any key to erase the message and correct the line.

IMPORTANT

If the Magazine Entry Program sees a mistake on a line, it *does not* enter that line into memory. This makes it impossible to enter a line incorrectly.

Error Messages and What They Mean

There are six error messages that the Magazine Entry Program uses. Here they are, along with what they mean and how to fix them.

NO CHECKSUM: This means that you forgot to enter the apostrophe and the four letters at the end of the line. Move the cursor to the end of the line you just typed and enter the checksum.

QUOTE: This means that you forgot (or added) a quote mark somewhere in the line. Check the line in the magazine and correct the quote.

PARENTHESIS: This means that you forgot (or added) a parenthesis somewhere in the line. Check the line in the magazine again and correct the parenthesis.

KEYWORD: This means that you have either forgotten a command or spelled one of the BASIC keywords (GOTO, PRINT..) incorrectly. Check the line in the magazine again and check your spelling.

OF CHARACTERS: This means that you have either entered extra characters or missed some characters. Check the line in the magazine again. This error message will also occur if you misspell a BASIC command, but create another keyword in doing so. For example, if you misspell PRINT as PRONT, the 64 sees the letter P and R, the BASIC keyword ON and then the letter T. Because it sees the keyword ON, it thinks you've got too many characters, instead of a simple misspelling. Check spelling of BASIC commands if you can't find anything else wrong.

UNIDENTIFIED: This means that you have either made a simple spelling error, you typed the wrong line number, or you typed the checksum incorrectly. Spelling errors could be the wrong number of spaces inside quotes, a variable spelled wrong, or a word misspelled. Check the line in the magazine again and correct the mistake.

C

Magazine Entry Program

```

1 PRINT "[CLEAR]POKING-";
5 P=49152:REM $C000
10 READ A$:IF A$="END"THEN 80
20 L=ASC(MID$(A$,2,1))
30 H=ASC(MID$(A$,1,1))
40 L=L-48:IF L>9 THEN L=L-7
50 H=H-48:IF H>9 THEN H=H-7
60 PRINT"[HOME,RIGHT12]"P;
70 B=H*16+L:POKE P,B:T=T+B:P=P+1
  :GOTO 10
80 IF T<>103233 THEN PRINT"MISTAKE IN
  DATA --> CHECK DATA STATEMENTS":END
90 PRINT"DONE":END
1000 DATA 4C,23,C0,00,00,00,00,00
1001 DATA 00,00,00,00,00,00,00,00
1002 DATA 00,58,C1,5E,C1,66,C1,76
1003 DATA C1,83,C1,8F,C1,EA,EA,EA
1004 DATA 4C,83,C0,A2,05,BD,1D,C0
1005 DATA 95,73,CA,10,F8,60,A0,02
1006 DATA B9,00,02,D9,3C,C1,D0,0B
1007 DATA 88,10,F5,A9,01,8D,10,C0
1008 DATA 4C,1F,C1,60,A0,03,B9,00
1009 DATA 02,D9,38,C1,D0,E0,88,10
1010 DATA F5,A9,00,8D,10,C0,4C,1F
1011 DATA C1,60,A0,03,B9,00,02,D9
1012 DATA 34,C1,D0,E0,88,10,F5,A0
1013 DATA 05,B9,A2,E3,99,73,00,88
1014 DATA 10,F7,A9,00,8D,18,D4,4C
1015 DATA 1F,C1,E6,7A,D0,02,E6,7B
1016 DATA 4C,79,00,A5,9D,F0,F3,A5
1017 DATA 7A,C9,FF,D0,ED,A5,7B,C9
1018 DATA 01,D0,E7,20,5A,C0,AD,00
1019 DATA 02,20,A3,C0,90,DC,A0,00
1020 DATA 4C,EA,C1,C9,30,30,06,C9
1021 DATA 3A,10,02,38,60,18,60,C8
1022 DATA B1,7A,C9,20,D0,03,C8,D0
1023 DATA F7,B1,7A,60,18,C8,B1,7A
1024 DATA F0,35,C9,22,F0,F5,6D,05
1025 DATA C0,8D,05,C0,AD,06,C0,69
1026 DATA 00,8D,06,C0,4C,BD,C0,18
1027 DATA 6D,07,C0,8D,07,C0,90,03
1028 DATA EE,08,C0,EE,0B,C0,60,18
1029 DATA 6D,0A,C0,8D,0A,C0,90,03
1030 DATA EE,09,C0,EE,0C,C0,60,0A
1031 DATA A8,B9,11,C0,85,FB,B9,12
1032 DATA C0,85,FC,A0,00,A9,12,20
1033 DATA D2,FF,B1,FB,F0,06,20,D2
1034 DATA FF,C8,D0,F6,20,54,C3,20
1035 DATA 7E,C3,20,E4,FF,F0,FB,A0
1036 DATA 1B,B9,3F,C1,20,D2,FF,88
1037 DATA 10,F7,68,68,A9,00,8D,00
1038 DATA 02,4C,74,A4,4B,49,4C,4C
1039 DATA 54,45,53,54,41,44,44,91
1040 DATA 91,0D,20,20,20,20,20,20
1041 DATA 20,20,20,20,20,20,20,20
1042 DATA 20,20,20,20,20,20,91,0D
1043 DATA 51,55,4F,54,45,00,4B,45
1044 DATA 59,57,4F,52,44,00,23,20
1045 DATA 4F,46,20,43,48,41,52,41
1046 DATA 43,54,45,52,53,00,55,4E
1047 DATA 49,44,45,4E,54,49,46,49
1048 DATA 45,44,00,4E,4F,20,43,48
1049 DATA 45,43,4B,53,55,4D,00,50
1050 DATA 41,52,45,4E,54,48,45,53
1051 DATA 49,53,00,C8,B1,7A,D0,FB
1052 DATA 84,FD,C0,09,10,03,4C,C7
1053 DATA C1,88,88,88,88,88,B1,7A
1054 DATA C9,27,D0,13,A9,00,91,7A
1055 DATA C8,A2,00,B1,7A,9D,3C,03
1056 DATA C8,E8,E0,04,D0,F5,60,4C
1057 DATA F2,C2,A0,00,B9,00,02,99
1058 DATA 40,03,F0,F2,C8,D0,F5,A0
1059 DATA 00,B9,40,03,F0,E8,99,00
1060 DATA 02,C8,D0,F5,20,D7,C1,4C
1061 DATA 56,C2,A0,0B,A9,00,99,03
1062 DATA C0,8D,3C,03,88,10,F7,A9
1063 DATA 80,85,02,20,1B,C3,A0,00
1064 DATA 20,9B,C1,20,CA,C1,20,31
1065 DATA C2,E6,7A,E6,7B,20,7C,A5
1066 DATA A0,00,20,AF,C0,F0,CD,24
1067 DATA 02,F0,06,20,D7,C0,4C,12
1068 DATA C2,C9,22,D0,06,20,BC,C0
1069 DATA 4C,12,C2,20,E7,C0,4C,12
1070 DATA C2,A0,00,B9,00,02,20,A3
1071 DATA C0,C8,90,0A,18,6D,09,C0
1072 DATA 8D,09,C0,4C,33,C2,88,A2
1073 DATA 00,B9,00,02,9D,00,02,F0
1074 DATA 04,E8,C8,D0,F4,60,18,AD
1075 DATA 0B,C0,69,41,8D,0B,C0,38
1076 DATA AD,0C,C0,E9,19,90,06,8D
1077 DATA 0C,C0,4C,60,C2,AD,0C,C0
1078 DATA 69,41,8D,0C,C0,AD,05,C0
1079 DATA 6D,07,C0,8D,0E,C0,6D,0A
1080 DATA 08,C0,8D,0E,C0,68,6D,0A
1081 DATA C0,8D,0D,C0,AD,0E,C0,6D
1082 DATA 09,C0,8D,0E,C0,38,E9,19
1083 DATA 90,06,8D,0E,C0,4C,96,C2
1084 DATA AD,0E,C0,69,41,8D,0E,C0
1085 DATA AD,0D,C0,E9,19,90,06,8D
1086 DATA 0D,C0,4C,AB,C2,AD,0D,C0
1087 DATA 69,41,8D,0D,C0,A0,01,AD
1088 DATA 0B,C0,CD,3C,03,D0,20,C8
1089 DATA AD,0C,C0,CD,3D,03,D0,17
1090 DATA C8,AD,0D,C0,CD,3E,03,D0
1091 DATA 0E,AD,0E,C0,CD,3F,03,D0
1092 DATA 06,20,64,C3,4C,7A,C0,AD
1093 DATA 10,C0,D0,11,98,48,68,4C
1094 DATA F7,C0,AD,10,C0,F0,01,60
1095 DATA A9,04,4C,F7,C0,A4,FD,A9
1096 DATA 27,91,7A,A2,00,C8,BD,0B
1097 DATA C0,91,7A,C8,E8,E0,04,D0
1098 DATA F5,A9,00,91,7A,20,64,C3
1099 DATA 4C,7A,C0,A0,00,B9,00,02
1100 DATA F0,11,C9,28,D0,03,EE,03
1101 DATA C0,C9,29,D0,03,EE,04,C0
1102 DATA C8,D0,EA,AD,03,C0,CD,04
1103 DATA C0,D0,01,60,A9,05,4C,F7
1104 DATA C0,A9,20,8D,00,D4,8D,01
1105 DATA D4,A9,09,8D,05,D4,A9,0F
1106 DATA 8D,18,D4,60,20,41,C3,A9
1107 DATA 81,20,77,C3,A9,80,20,77
1108 DATA C3,4C,71,C3,20,41,C3,A9
1109 DATA 11,20,77,C3,A9,10,20,77
1110 DATA C3,A9,00,8D,04,D4,60,8D
1111 DATA 04,D4,A2,70,A0,03,88,D0
1112 DATA FD,CA,D0,FA,60,END

```


USER GROUPS

Commodore user groups nationwide and around the world provide invaluable assistance to Commodore computerists. If you are looking for people who share your computing interests, or if you need help getting started with your computer, contact the group near you.

This list is compiled from groups who responded to a survey conducted by Pete Baczor, Commodore's user group coordinator. If you would like your group to appear here, or if you need information about Commodore's user group support, contact Pete at Commodore Business Machines, 1200 Wilson Drive, West Chester, PA 19380.

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User Group Support Program

Commodore is creating a program to support Commodore User Groups.

The two major components—an electronic bulletin board on CompuServe and a newsletter are now available.

The electronic bulletin board is a dedicated section of the Commodore Information Network of CompuServe accessible only by "Approved" User Groups. It will be used for direct communication as well as Commodore announcements.

The newsletter, INPUT/OUTPUT, will include announcements, user group programs, calendar of events, letters, questions, product specifications, programs, and surveys. It will be a newsletter FOR user groups BY user groups supported by Commodore without advertisements.

For future issues of the newsletter Commodore is accepting announcements of user group activities, articles of interest, letters to the editor, and general questions. Please forward all correspondence with the name of your user group to:

Commodore Business Machines
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Attn: Mario Eisenbacher
Editor, INPUT/OUTPUT

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HOME OFFICE

Continued from page 24

The word processor produces 77 characters per line for up to 99 lines a record, though it can display only 37 of the characters at a time. Users view the balance through horizontal scrolling under cursor control.

Its length limitation is another matter. Though 99 lines are enough for most applications, there will be those which require greater storage capacity. When that happens, lengthy files must be stored in sections to be merged as printed.

Besides the basic word processing functions like insertion and deletion of characters and lines of text *Your Home Office* offers a topnotch search-and-replace routine. Specified terms are highlighted in a sequential user-controlled process which permits customized changes.

An important subset of options includes the power to copy, insert and delete multiple lines of text. These features make it easy for anyone to painlessly edit drafts until the finished work is a masterpiece. As many as 15 lines of text can be handled with these commands.

Along the same path is the recall function: a way to restore a single line of accidentally erased text. It can do wonders for anyone with a case of wandering fingers!

The other major section of the word processor deals with printer output. ASCII-based commands can be sent to drive the printer of your choice. Features like boldface, shadowprint, underline and enhanced mode are possible.

Format commands include page length and margin widths as well as justify, wrap and pause (to change forms or print heads). Other options include pagination, file linking, line spacing and adjustment to paper size. These are to be used with any of the previously described font commands.

Unfortunately, there is one rough spot. The reverse video mode text-embedded commands work only on output. Short of printing documents, there's no way to view the format setup. Experience using the software does minimize this problem, though.

Despite a few soft spots, it's clear that *Your Home Office* is a good value for home, school and small business users.

KNEEBOARD

Continued from page 52

Now, this is important, so pay attention. If the braces are installed the other way around—vertical end pointing up—the shelf won't fit into the knee-hole cavity because the braces themselves will occupy some of its opening. You'll end up having to trim the edges of the shelf.

We're going to put the one-inch braces toward the front of the desk, two on each side, naturally. They will be spaced two inches apart, with the first pair one inch back from the front edge of the desk.

The 3/4-inch braces will go further back in the knee-hole, three inches from where the rear of the shelf will reside in its "home" position. If your shelf is 14 inches deep, this will put the brackets 11 inches from the front edge of the desktop.

Before installing the corner braces, it's a good idea to test your shelf in position for levelness and ease of glide. You can temporarily fix the braces in position with masking tape, a single nail or best of all, two-sided carpet tape. The reason I recommend the carpet tape is that you can, and should, leave it in position after you've tested the braces and screwed them in place. The tackiness of the tape will help keep the braces from swiveling, which they may do if you give your shelf a lot of usage. Before screwing the braces in, test the shelf with a level and mark the correct positioning of the braces. Then screw them in securely.

Before sliding the shelf home, we'll install "stops." These are two small screws placed on the underside of the shelf, 3/4 inch from the back edge and between 3/4 and one inch from either side. Don't sink the screws to their heads; leave about two spirals exposed. Properly positioned, the screws will easily clear the small brackets when the shelf is pushed in, but will engage the middle pair when it's pulled out.

If the shelf feels like a tight fit, a little soap on the brackets will help it glide smoothly.

The final step is to install a decorative pull in the center.

With the \$10 Keyboard Kneeboard firmly in place, you have alleviated at least one computer clutter problem. Now, what can we do about that infernal tangle of cables?

LOGIC LEVELS

Continued from page 26

dows with the prizes behind them while avoiding the frowning faces. You receive points for each prize.

Select your level of play—level one, two or three. The higher levels have more prizes as well as more frowning faces to avoid. In level three, the game ends when the sun sets.


Begin by using your joystick to fly your helicopter in order to fill six buckets with window-washing fluid. There are six buckets in each of the two buildings and you can fill any six up—all six in one building, three in one, three in the other, whatever. (Although you're not timed in this game, your child can work out a placement strategy he or she sees as the most effective and quickest.)

As you fly around, you'll notice the prize animals or sad faces behind some of the windows—a cat, butterfly, bird and several frowning faces. You'll need to try to remember where the "prizes" are so you can wash those windows and also where the unhappy faces are so you can avoid them. Why? Because you can do about five windows with one bucket, but if you wash one frowning face window, you lose all the fluid in your bucket!

After your six buckets are full, Willie jumps up and down, a signal it's time for the helicopter to pick him up. But just as you get Willie to the building and the helicopter flies away, a raincloud suddenly appears, drenching all the windows—and you can no longer see what's behind those windows.

So you must help Willie by remembering the right windows. Using your joystick, move him up and down ladders to the right places. When he runs out of washing fluid, you'll hear a honking sound, signifying it's time to refill.

Memory Manor is designed for children ages four through eight. It's challenging and fun. The graphics are very good—as is the sound. My son and I especially loved the realistic sound of the helicopter in flight. We also liked the simple sounds of Willie actually washing the windows.

Both *Logic Levels* and *Memory Manor* should provide hours of learning and enjoyment for your children. I recommend them highly. 

ELECTRONIC COTTAGE

Continued from page 69

Using the Software Highway, we may, ironically, come full circle, back to working where we live.

Austerlitz is a little surprised by some of his students. "Computers are being mis-used," he says. "When you see them as a toy more than as a tool, it's almost a waste." But Pamela McCorduck, Columbia University English professor and co-author (with Edward A. Feigenbaum) of *The Fifth Generation* says half of her students use word processors. "I don't have to correct their spelling," she says. "That leaves me free to do more interesting work."

A lot of universities—Drexel University in Philadelphia, Carnegie-Mellon and others—are force-feeding microcomputers to their new students, regardless of program. Or depending on your views, they offer students the privilege of buying or renting the computers, often at substantial discounts. And they are being used: for design, for math, for science, even (shudder) for art. Babes in elementary schools are using them with software by companies like MicroEd in Minneapolis. MicroEd is leading the way, right now, with software that coordinates the computer with a laser disk video machine to teach subjects like the Civil War. You have to learn the basics, even in a computerized world.

Austerlitz says, "We're at the start of the growth curve. I expect to see a lot more students familiar with computers. Five years from now, they might bring them to class as a matter of course, the way they do with calculators now."


On the other hand, psychologist Kegan thinks, "The big boom didn't quite happen." And Robert Mittman agrees. "Computers haven't panned out as quickly as some thought they would five or so years ago," he says. Author Bear, working on a new computer book with co-author William Moore, still does much work by mail (and not EMail, either) rather than mo-

dem, and does not yet use his computer to bank or shop. "Not that many people do," says Mittman. "A technical success doesn't necessarily mean a marketing or commercial success."

But there are interesting things on the horizon. Among them, household systems in which appliances, security devices, lights and phones are controlled by microprocessors. It makes me think of Buster Keaton's old silent movie, "Electric House," where all the stuff in it was electric.

And there's also the future of voice recognition to consider. Already available in a limited fashion (hardware that allows a machine to understand a few hundred spoken commands from a particular person), voice recognition systems will, Mittman feels, be promising for business executives. "Executives have a kind of keyboard phobia," he says. "They're used to things like dictaphones. The first really good voice recognition system should make a mint." His best estimate is that they'll be here by the mid-1990's.

But who knows? I'm not saying. I won't stick my neck out any farther, nosiree. Most predictions, whether made by tossing a magpie feather into the wind, or belabored with the help of a thousand-bucks-per-hour Cray supercomputer, turn out to be wrong anyway, providing hours of fun for future generations. John Bear doesn't even think that he'll use a voice recognition system—at least not at first. He likes the keyboard ritual. And, he says, "Anyone who predicts the future of computers is likely to be both wrong and embarrassed. They were once predicting that computers would eventually weigh as little as a ton." Remember those World Fair Futuramas? Underwater hotels? Moving sidewalks? Hee hee.

But just in case the Software Highway comes around a little sooner than expected, and we do all start staying home, what on earth are we going to do with all those miles of blacktop? 

Freelance writer Kiel Stuart is Director of the Northshore Arts Alliance in Stony Brook, New York, and a member of the Science Fiction Writers of America. She writes a regular science column for Beyond magazine, published by Alan Weston Communications.

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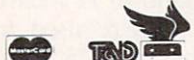
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PFS:File

Continued from page 17

not state-of-the-art, it does its job quickly and well.

Cons

As previously mentioned, up to 50 item names can be defined. However, there isn't a routine that warns the user that the limit has been reached. When I first tested *PFS:File*, I entered in a form containing 55 fields but only 50 registered. Since I hadn't read the manual (at that time), I couldn't figure out what happened to five of my item names.

When a user deletes a record, disk space becomes available. However, the form number is never used again. In order to renumber the remaining forms in your file, so that they are consecutive with no gaps, the Change Design option of the "Design File" mode must be executed.

Another problem occurs in the print format. When *PFS:File* prints out information from your files, it prints items in the order in which they appear on the form. For example, the chairman of a company may be in item #1, while the president of that same company may be in item #2. *PFS:File* allows you to print the chairman's name only, the president's name only, or both the chairman's and president's names in that order. But *PFS:File* will not allow you to print the president's name before the chairman's name. With this very important limitation, extreme care must be exercised when planning the item name format. (*PFS:Report*, however, allows more printing flexibility used in conjunction with *PFS:File*.)

When printing a record, a constant two characters of space is automatically inserted between item variables. This may not "look right" in some formal addressing situations. Care must be taken to allow for sufficient space between item names. The temptation to crowd item names onto a single line must be overcome in order to utilize the "Search" mode efficiently. Fortunately, *PFS:File* has a warning bell built in, which activates when variable data is longer than the space between two item names.

While I do not recommend *PFS:File* in an average business situation, it is perfect in many vertical applications where the data base is light-duty and tailor-made to that application. **C**

PASCAL 64

Continued from page 34

Formatted output is possible. A variety of graphics statements are included and their use is demonstrated. Both high-resolution graphics and sprite statements are provided for and the execution of machine language programs is possible from within a Pascal program. Integer arithmetic is enabled or disabled by a single command in order to accelerate the computations (whenever it is possible, of course). *Pascal 64* allows interrupt control, that is, it is possible to direct interrupt operations to Pascal subroutines. As a result, two programs may seem to execute simultaneously. The *Pascal 64* compiler, loader and linker reside on a single diskette. A user's guide is provided with the software. The guide provides a tutorial which can be used for learning the fundamentals of Pascal. A list of references is given and it is recommended that the user use additional text for studying the language. The manual also explains the specific features of *Pascal 64*, which is a special version for the 64. It even provides useful programs for demonstration and for use as part of a general-purpose subroutine library.

The *Pascal 64* manual contains a brief discussion on structured programming. A short section deals with the use of machine language programs and the Assembler/Monitor package (also by Abacus) with *Pascal 64*. An overview of *Pascal 64* provides a quick reference.

In the January/February *Commodore Microcomputers*, a BASIC program for matrix multiplication is given. I performed the same operations using a *Pascal 64* program. A comparison between the two programs, for matrices of 100 elements, indicates that execution time for the Pascal program is eight times shorter than that of the BASIC program. This fact demonstrates one of the important advantages of Pascal over BASIC for extended computations.

In summary, *Pascal 64* is an invaluable package for studying structured programming and for development of efficient software. It is recommended for users who want to extend the capabilities of the 64 without studying machine language, or for those interested in extending their own computer skills. **C**

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INTERACTIVE VIDEODISC

Continued from page 78

say you decide that you'd like to learn more about gourmet cooking. Instead of buying a cookbook, you purchase an interactive laserdisc and learn the nuances of fine food preparation from Julia Child herself, all with the help of your Commodore 64 and your laserdisc player. Since the programming is interactive, you can pause it, replay a section that you weren't paying enough attention to, skim around looking for creative desserts or whatever suits your fancy.

Or consider this: you've entered a large shopping mall and you need to purchase a polka-dotted blivet as a gift for that person who has everything. Rather than traipsing around the mall for the better part of the day, you walk up to one of the interactive computer/laserdisc consoles at the entrance of the mall, type in "blivet, polka-dotted" at the inquiry prompt, and the console responds with a listing of five stores within the complex that carry the item. Rather than visiting each store in person, you scan each one with the joystick until you find that "Blivet World" has exactly the gift you're looking for. When you move the joystick once again, the laserdisc zips into floorplan mode, which shows you where you are, where "Blivet World" is, and exactly which escalator takes you there directly. Imagine the time and frustration you've saved yourself!

Although these examples sound a bit far-fetched, I assure you they aren't. Such educational and point-of-purchase installations are gaining attention and wide acceptance all across the nation. In fact, Allen Communication, one of the pioneers of interactive video, has been enjoying phenomenal success with their line of interfaces, systems and courseware using this very technology. Their product line includes the MVP (Most Valuable Peripheral) Interface, a device that allows you to connect your Commodore 64 with your home laserdisc player and use it for your own applications. The Learning Link Corporation and MicroEd, Incorporated, are also deeply involved in the interfacing of laserdiscs and computers.

Almost daily, more and more companies are jumping on the interactive video bandwagon, and every major software and peripheral manufacturer

Rather than traipsing around a mall for the better part of a day, just walk up to an interactive computer/laserdisc console and type in what you're looking for.



has expressed some interest in the field. Interactive laserdisc technology is already being used in the amusement arcade industry, with such coin-operated games as *Dragon's Lair* and *Mach I* enjoying immense popularity with video game fans. And that is only the beginning.

As interactive video gains acceptance, we, as consumers, can look forward to lower prices for home systems and a proliferation of fine subject matter. We're on the brink of another electronic educational revolution—only the tip of the iceberg is presently showing.

At a recent electronics trade show, I heard rumors that a major Japanese video manufacturer would be releasing the first erasable/recordable videodisc within the next few months

(they are presently *play-only* machines, with no ability to record or erase). The availability of such a system, coupled with the sophisticated authoring systems already available from Allen Communication and other major interactive video firms, promise to turn education as we know it today on its ear. Teachers and educators will be able to custom-design and author specific courses. The slower student won't have to get brain-strain trying to keep up with his or her brighter classmates—they can learn at a pace comfortable to themselves, repeating segments of the course material over and over until the concepts are thoroughly understood.

There are other far-reaching implications to benefit the handicapped and learning-disabled that we haven't even touched upon yet. The uses of interactive video for speech and physical therapy are among the most intriguing. Quadrapalegics and other severely handicapped persons may be able to continue their education right through post-grad degree programs thanks to interactive video technology.

The coupling of the videodisc to the computer may be a significant contribution to the betterment of mankind. It's an exciting field of technology with exciting possibilities—indeed it is an interactive laserdisc revolution! **C**

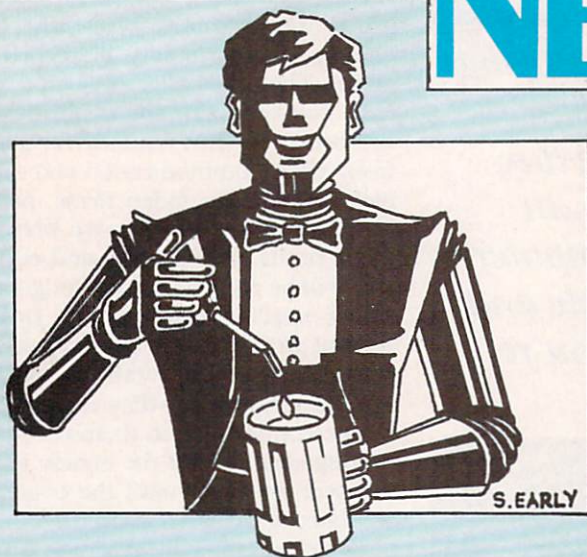
INTERFACING YOUR COMMODORE 64 WITH A VIDEODISC

If you'd like more information on interactive videodisc systems that can be interfaced with your Commodore 64, contact these firms directly:

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Salt Lake City, UT 84116
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MicroEd, Incorporated
P.O. Box 24156
Minneapolis, MN 55424
(612) 944-8750

Learning Link Corporation
2880 South Main, Suite #111
Salt Lake City, UT 84115
(801) 466-9276



Electronic Bartender

WTC Publishing (131 NW Fourth Street, Suite 25, Corvallis, Oregon 97330) has introduced the **Electronic Bartender** for the Commodore 64 to help with your bartending problems.

The **Electronic Bartender** serves large groups well because it multiplies recipes automatically. It also displays a picture of the correct glass in which to serve your drinks. Let the **Electronic Bartender** show you how to stock your bar more efficiently. Tell it what supplies you already have and it tells you what ingredients to buy next to maximize your possible recipes. Perhaps the best feature of this new product is that it won't set you back a case of cognac. For just \$19.95, the **Electronic Bartender** gives you more than 300 drink recipes and a quick response to your every command.

Mass Storage System

Computer Products International (740 S. Hillview Drive, Milpitas, California 95035) has introduced a networkable Universal Mass Storage system. The system ranges in capacities from ten through 368 megabytes, has optional tape back-up, includes full multiplexing and networking capability and is available for over 30 different computers. In addition, the Universal Mass Storage System provides a common storage area which may be accessed by users of different computer systems. This means that your Universal Mass Storage System may be connected to different microcomputers, thus giving a shared storage environment.

Computers For The Blind

Talking computers give blind and visually impaired people access to electronic information. The question is how and how much?

The answers can be found in "The Second Beginner's Guide to Personal Computers for the Blind and Visually Impaired" published by the National Braille Press. This comprehensive book contains a Buyer's Guide to talking microcomputers and large print display processors. More importantly it includes reviews, written by blind users, of software that works with speech.

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Six-Voice Synthesizer

Sequential Circuits (3051 North First Street, San Jose, California 95134) has introduced a new six-voice computer-based instrument called MAX for composers and performers. At a suggested retail price of \$795, MAX is equipped with MIDI (Musical Instrument Digital Interface), a music industry standard. MAX can play back-up to six different instrument sounds and musical lines at the same time. Sequential provides software for composing, editing and printing a musical score created on MAX when used in conjunction with a Commodore 64.



BBS User Guide

CompuSystems Management (4734 East 26th Street, Tucson, Arizona 85711) announces the *BBS User Guide*, a full-sized manual with down-to-earth accurate information on how to design and maintain your own Commodore-based bulletin board/computer information system.

Directed toward home or general computer users, user groups and businesses that have a need for a bulletin board system, this book will save weeks of misapplication, time and money.

The book retails for \$21.95.

Telecommunications Book

Osborne/McGraw-Hill, Berkeley, California, announces the publication of the book *C-64 Telecommunications* by Jonathan Erickson. The author introduces the concepts of telecommunications and clearly explains what the 64 user needs to know to fully utilize on-line services. Popular information data bases and networks are described, and hardware and software requirements are discussed so readers can evaluate their needs before investing in a system. Suggested retail price is \$14.95.

Graphics Interface

Progressive Peripherals and Software of Denver, Colorado, has announced a new product from its hardware division, Easy Print with Graphics. This graphics interface is designed for use with the Commodore 64 and VIC 20, requires no software and connects to nearly all Centronics parallel printers.

Easy Print with Graphics prints the full Commodore character set including all graphics characters. Its enhanced list mode translates special Commodore characters into easily understood English words, and is capable of printing sprites, custom character sets, and high-resolution or color-bit maps with shading.

Dr. Seuss Software

CBS Software (One Fawcett Place, Greenwich, Connecticut 06836) has released *Dr. Seuss Fix-up the Mix-up Puzzler* for the Commodore 64. This is an electronic jigsaw puzzle that features six favorite Dr. Seuss storybook characters including the Cat in the Hat. Each puzzle is randomly designed by the computer, allowing for dozens of different character combinations, with five skill levels from which to choose.

In level one, children can mix and match heads, bodies and feet creating zany new characters. In more advanced skill levels, puzzles are divided into smaller pieces that are scrambled by the computer. As children reassemble the puzzle, they can compete against a built-in timer. When the puzzle is completed correctly, the Dr. Seuss characters come to life through on-screen animation.

ADVERTISERS' INDEX

Sky Travel Challenge: Answers

Destroy Before Reading

1. Polar bear in Alert, Canada, 82°N - 63°W, visible 3000 B.C. to 3000 A.D., N
Clue is obvious.
2. Empire State Building, New York, 40°43'N - 74°01'W, May 1937 to May 1937, SSW
Clue is "empirically stated" + "billing" + "top".
3. CN Tower in Toronto, 43°42'N - 79°18'W, January 1970 to January 2070, SW
Clue is "see an" = "CN"; "two on tour = Toronto backwards, "highest" + "without . . . support" = CN Tower is tallest unsupported structure.
4. Gateway Arch in St. Louis, 38°38'N - 90°11'W, July 1948 to July 1948, NNE
Clue is Gateway Arch looks exactly like half of a MacDonald's sign, so . . . "hungry", "half-wit," and "hamburgers" give it away.
5. Mount Fuji in Tokyo, 35°42'N 139°48'E, 4713 B.C. to 9999 A.D., NE
Clue is "Canadian Police" = "mountie" + "fugitive" = MOUNTie FUGitive, right?
6. St. Basil Cathedral in Moscow, 55°48'N 37°42'E, 1555 A.D. to 2001 A.D., NW
Clue is "mosque" + "How" = Moscow.
7. Golden Gate Bridge in San Francisco, 37°48'N - 122°24'W, 1937 to 1937, WNW
Clue is "don't cross" + "until" + "come to it" = don't cross the bridge until you come to it, + "suspenseful" = suspension bridge.
8. Penguin in Sir James Ross, Antarctica, -68°S - 56°W, 3000 B.C. to 3000 A.D., S
Clue is "Betsy" as in Betsy Ross, "Jim" as in James, and "pen" + "go in" = penguin.
9. Pyramid at Giza, Egypt, 29°45'N 31°18'E, 2613 B.C. to 7000 A.D., N
Clue is "200 steps . . ." Marks off a square like the base of the pyramid and "peer amid."
10. Eiffel Tower in Paris, 48°53'N 2°18'E, 1889 to 2889, SSE
Clue is "plastered" = plaster of Paris, and "I fell" = Eiffel
11. Big Ben in London, 51°30'N 0°12'E, 1859 to 2859, SSW
Clue is "gentle" as in Gentle Ben + "big" = Big Ben; "watch out" means clock.

[Author's name withheld for protection from angry readers.]

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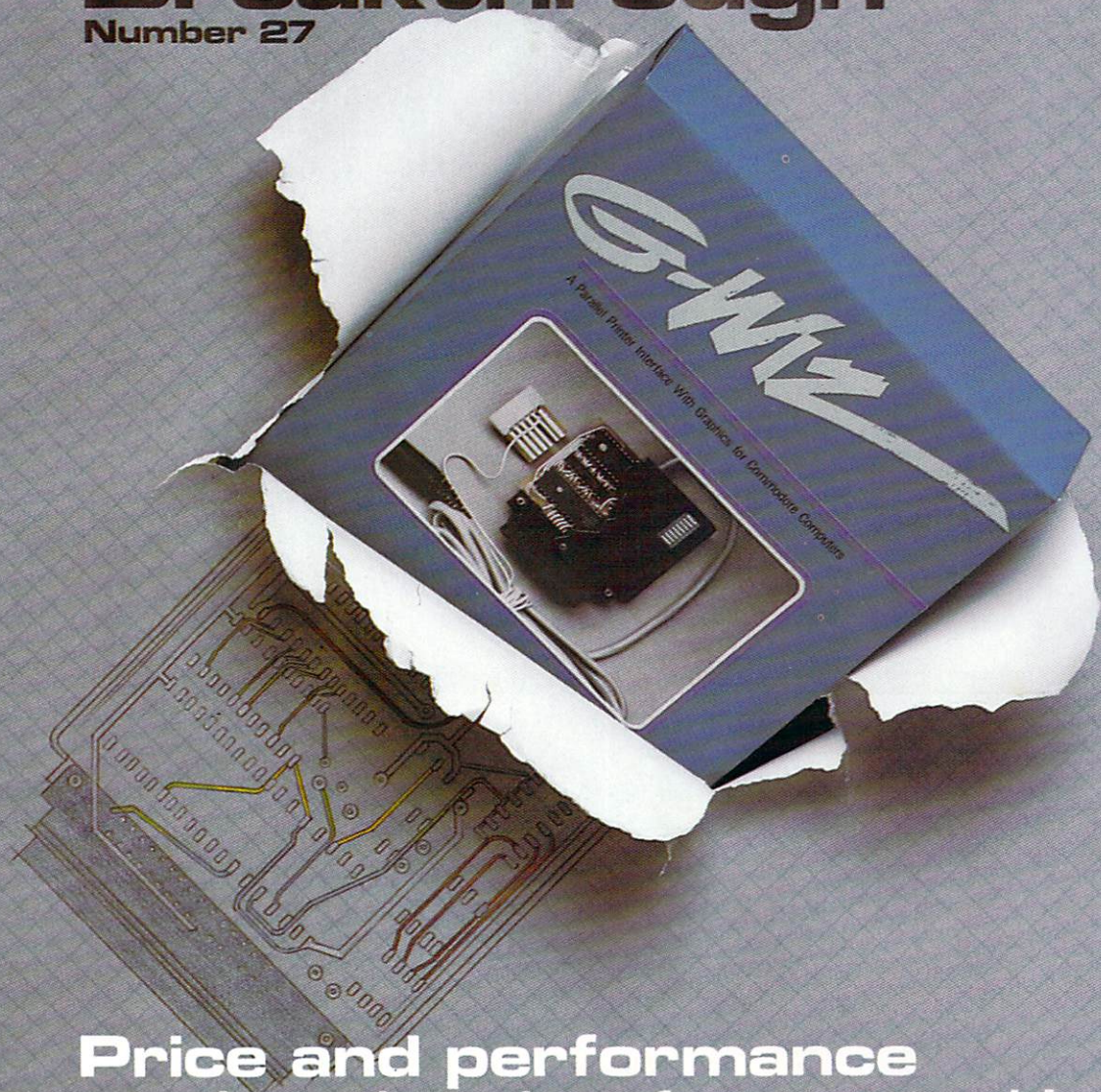
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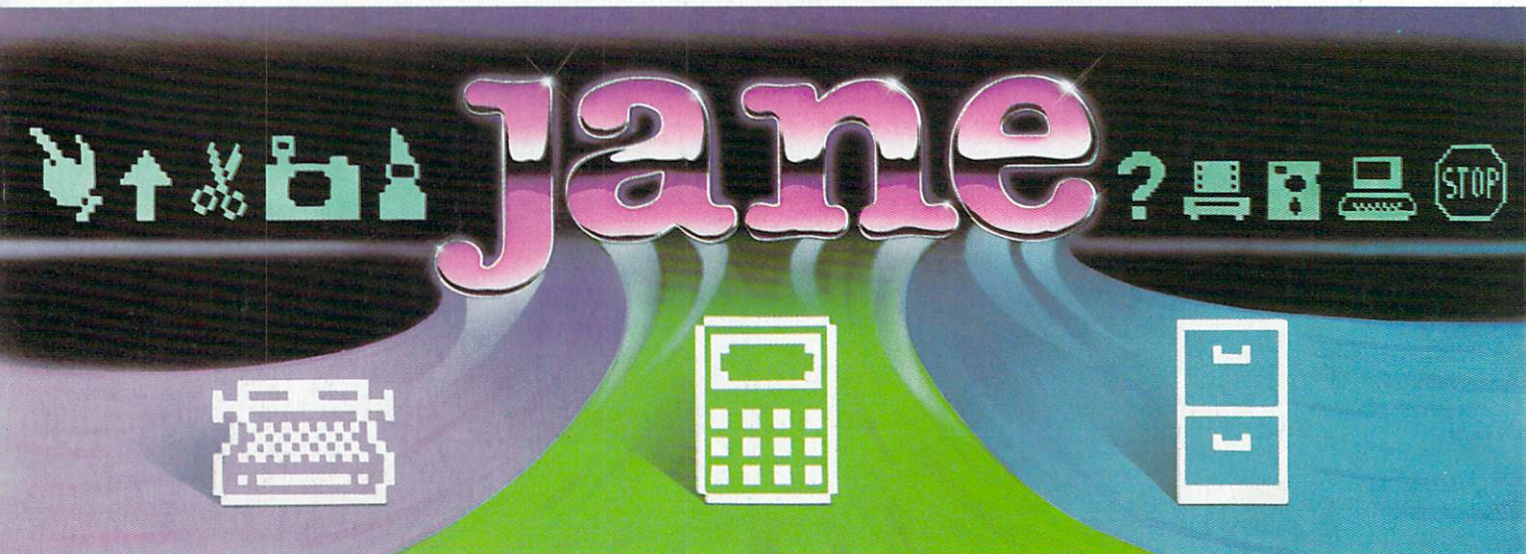


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